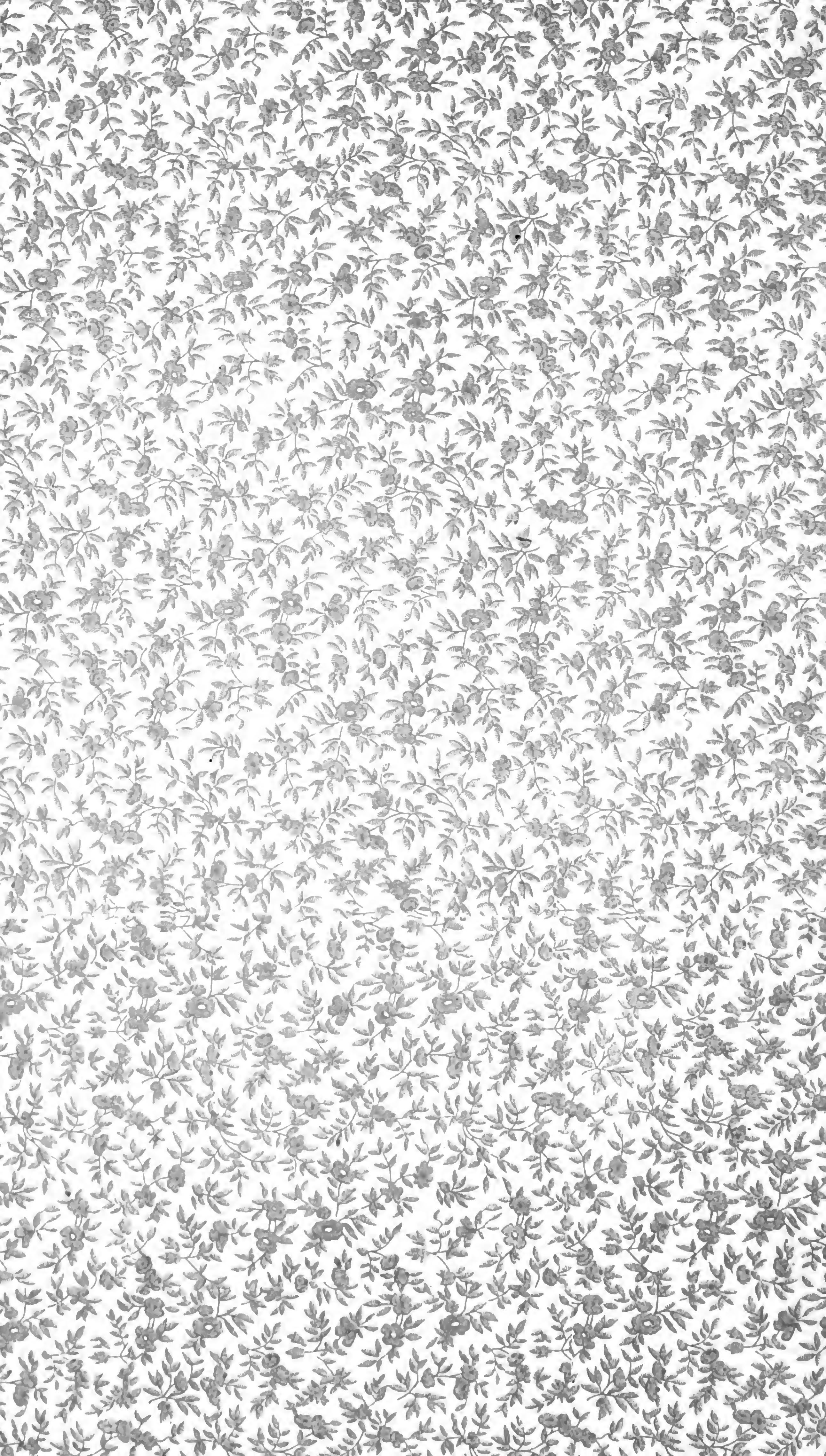

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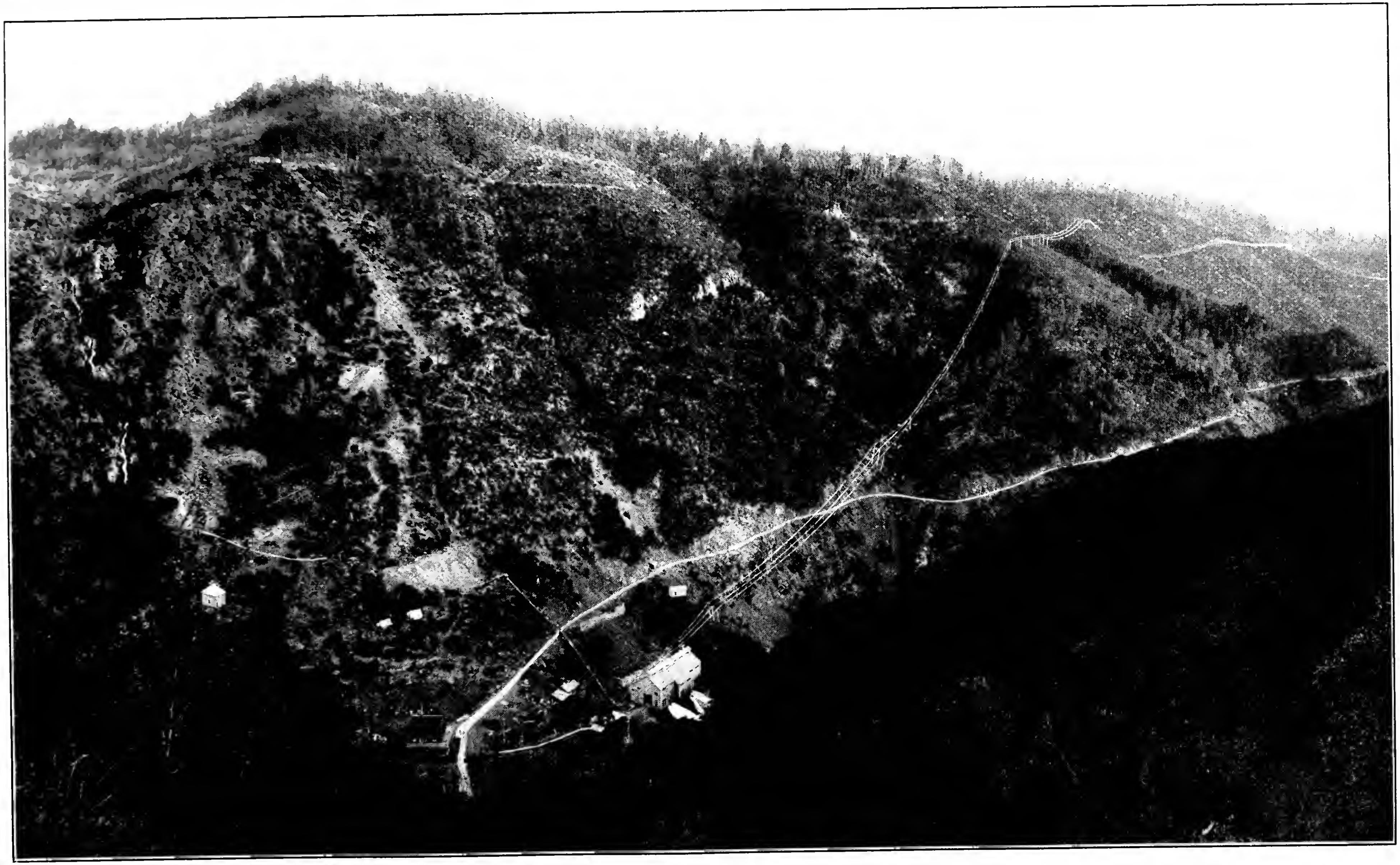


BIRDSEYE VIEW OF THE DE SABLA POWER PLANT ON BUTTE CREEK IN BUTTE COUNTY, CALIFORNIA

The great buried pipe-lines shoot water straight down that hill from a mountain lake, but the wagon road winds round five miles to make the descent. Silvery white aluminum cables carry the electricity off over the ridges to the far-distant cities

PACIFIC GAS AND ELECTRIC MAGAZINE

VOL. II JUNE, 1910 No. 1

De Sabla and Centerville Power Plants

By ARCHIE RICE, Publicity Manager.

Archie Rice

The black mule team sloshed through patches of snow. Towering pines stood sentinel-like along the lofty tableland. Forests and vistas of evergreen ridges on all sides suggested vast solitudes close up under the gray vault of the heavens.

Then the road descended and serpentined down and down. The sure-footed blacks never slackened their speed. We took the turns at almost a runaway rate. Each outer sweep close to the edge of the deep, sloping cañon brought its instinctive thrill. What might happen should an animal stumble, a wheel come off! The whole outfit would go tumbling, bounding, smashing, and mangling down, down, down, nearly a mile into the depths.

Five miles of that winding descent and we were finally at the bottom of the defile, but only a little more than a mile from the mountain lake up in the forest whence we had started.

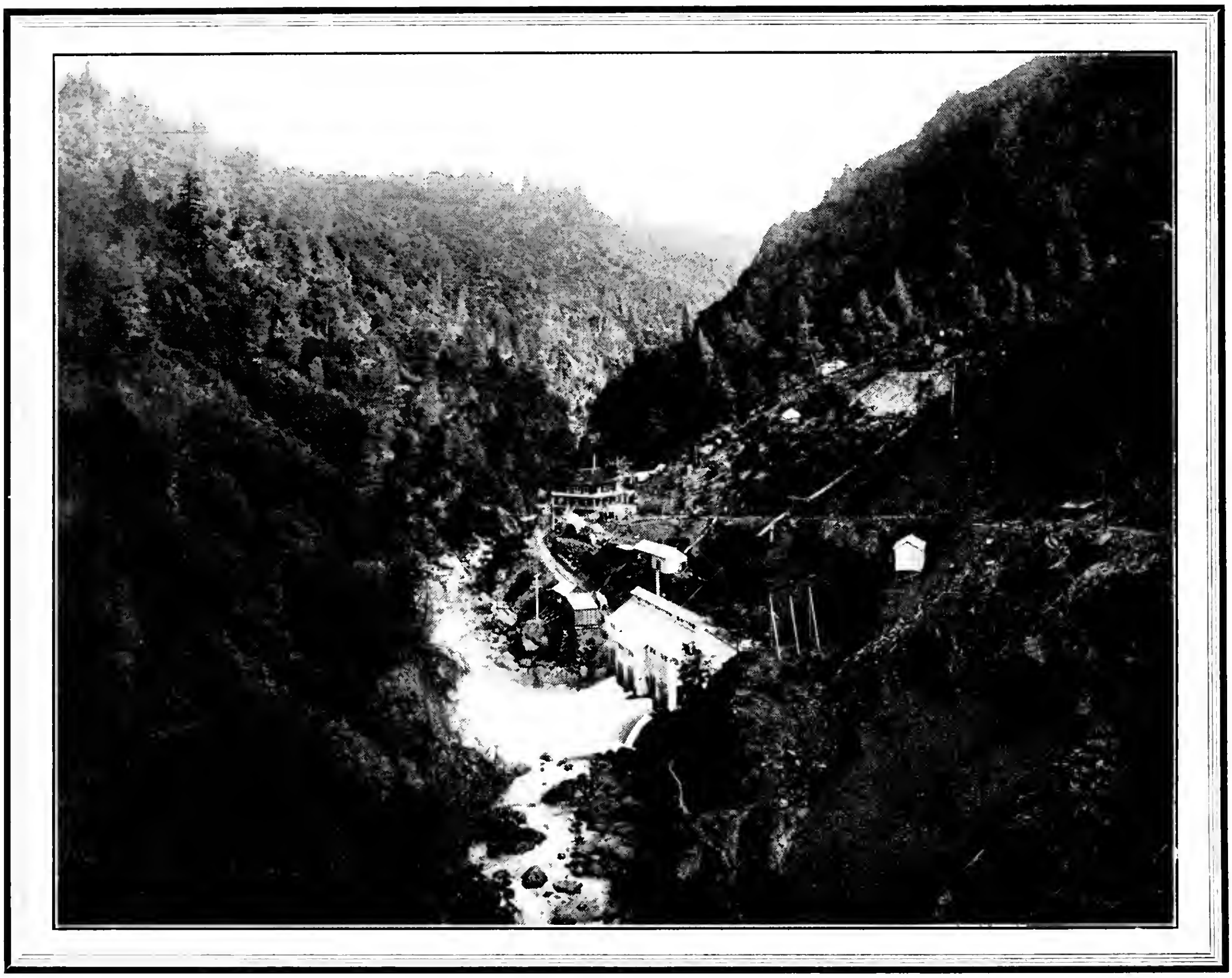
A building gleaming silvery white clung on a blasted-out shelf at the edge of the stream. The surrounding browns and dense foliage greens and the vari-colored rock strata of the precipices made this work of man stand out glaringly in a scene wonderful for its natural picturesque beauty. No photograph can do it justice. The place is a bit of Switzerland with a touch of the Grand Cañon of Arizona.

The noise of thundering waters was akin to the incessant muffled boom and moan of the mighty Yosemite Falls. Spray-clouds rose out of the gorge by the silvery building and covered half an acre with mist like fine drizzling rain. But where was the waterfall?

Monster steel pipes coming underground down the slopes were carrying torrents of water from that mountain lake and shooting it 6,000 feet at an incline to let it batter with tremendous force against water wheels under the building. The noise of waters, the rocketing and crashing were the escaping jets darting across and fighting and gradually conquering and loosening the granite masses of the opposite bank.

Here was the De Sabla Power House. In that silvery building were being constantly generated 17,420 electrical horsepower, enough energy to maintain continuously and all together 260,000 electric lights of sixteen-candle-power each.

This was Butte Creek, in the northern part of Butte County, in the northeastern part of California. All that thundering water flung into the stream was but a temporary loan. Down a little way a dam diverts it into a ditch and flume system that winds by a gentle descent for eight miles and then drops the water nearly six hundred perpendicular feet



The De Sabla power plant, showing the boarding-house in the background

through big steel pipes to propel wheels that generate 8,576 electrical horsepower at another plant called the Centerville Power House.

Then the creek finally receives the twice-worked water and goes winding meekly on down some twenty miles or more to make its contribution to the main river of the Sacramento valley. On flow those waters for many miles into San Francisco bay. They go out with the tide through the Golden Gate into the mighty Pacific. Abundant sunshine takes up the ocean moisture. The tradewinds waft the saturated atmosphere far inland. The towering white crests of the great wall of the Sierras check the clouds, chill them, and take tribute in myriad snowflakes to renew California's mountain streams and rivers. Nature in her bounty is nowhere wasteful.

California's inland rampart is the lofty wall of the Sierra Nevada Mountains. The slope is steep and high. It is gashed with streams that come down suddenly into the great interior valley. Heavy rains in the forest regions and melting snows in the summer maintain the flow of waters, and here and there man has built storage reservoirs to guard against the shortage of a possible dry season. Such are the conditions that have made California wonderfully rich in mountain water power, in matchless possibilities for hydroelectric development.

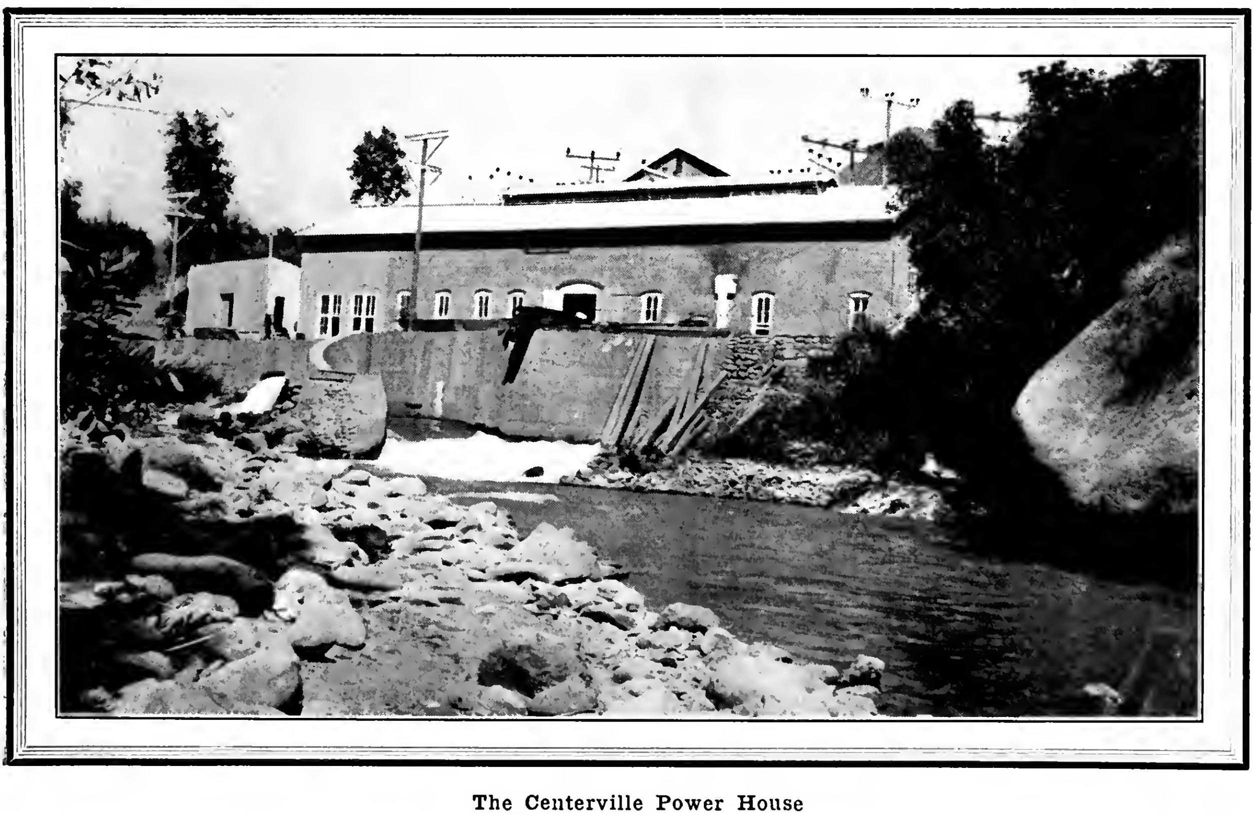
Way up toward the right-hand corner of the map of California is Butte County. It is an area larger than the state of Rhode Island. Its eastern edge follows the crests of the lofty Sierra. On the west it skirts the Sacramento River down in the great valley. But as a whole it is two-tenths mountains, heavily tim-

bered; five-tenths foothills, rolling, piling slopes of partially bald or oak-timbered country; and three-tenths fertile valley lands, where grow the orange and the olive in great productiveness and where the rain seldom varies from an annual fall of twenty-five inches. The Feather River divides the county, and Butte Creek, on which stand the De Sabla and Centerville electric power plants, cuts diagonally down across its northern third.

To reach these two power plants we went by rail to Chico, a community of about 12,000 people and the principal city of Butte County. Thence we climbed some 2,500 feet up into the Sierras on the Butte County Railroad, winding gradually up and up, through Paradise and on to Magalia, where the mule team was to meet us. Magalia is a station near the top of a ridge, and the immediate outlook is down into densely forested cañons. Five miles away through the forest is Camp One, at the storage lake that supplies water to the hydraulic plants. But from the Centerville power plant we drove back to Chico by wagon road a dozen miles or more down along Butte Creek and then across the valley country.

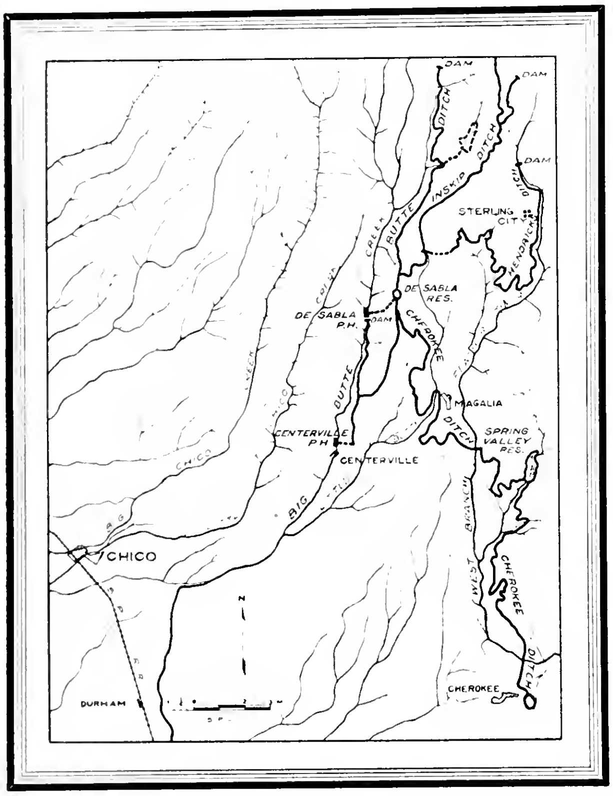
Those two plants delivering their electricity into the same power line of three big aluminum wires at an intensity of 60,000 volts, supply many industries, light many towns, and send their subtle energy even to a distance of two hundred miles to communities about San Francisco bay.

The smaller plant at Centerville is the older one. Back in 1898 the Butte County Electric Power Company was incorporated by O. W. Meysenberg, Judge J. A. Waymire, S. C. Dennison, H. B. Snow, and C. C. Jones. Work was started at once on the proposed plant, but it was continued leisurely. In February of 1900 H. W. Heath became a director in the company and Park Henshaw, by reason of his large investment, was elected president. The power house was completed, and a transmission line to Chico was ready for service in May of 1900. The entire investment up to that time had been $175,000.



The Centerville Power House

The plant started with two transmission lines in operation. One was to Chico, fourteen miles. The other was thirty-two miles to Oroville and the gold dredgers on the Feather River. This gave a total transmis-



Showing location of De Sabla and Centerville power plants, water ditches, and nearest towns in Butte County, California

sion service of forty-six miles. In August of 1901 the line to Chico was continued down the Sacramento valley to Colusa, forty miles. An independent line was also run from the power house to a junction with the Chico-Colusa line. Thus the system consisted of three main-line pole-lines from the power house, and all were of copper wire throughout, with an aluminum cable extension for the Oroville dredging district. Telephone lines were put on all the pole-lines and these telephone wires were transferred every tenth pole. When this power plant and the company controlling it were bought by the founders of the De Sabla system the Centerville power house was delivering four hundred kilowatts to Chico through two 200-kilowatt transformers, one hundred and fifty kilowatts to Gridley through two 75-kilowatt transformers, one hundred kilowatts to Colusa through two 50-kilowatt transformers, and about five hundred mechanical horsepower to the gold dredgers on the Feather River.

Improvements and developments had been planned for the Centerville plant, but they were not made until after the transfer to the new ownership. The original machinery was all mounted on heavy cast-iron floor plates set in masonry foundations. Soon after the larger concern had absorbed this plant it introduced extensive improvements, put in more machinery, added to the water power, and generally increased the value and effectiveness of the property.

But how came the De Sabla power plant to be founded? I put the query to the man who conceived the idea of that development. He is a busy man, and I fired questions at him, and his stenographer recorded his words. Even in the secured privacy of his inner office important interruptions came at the rate of one every two minutes. Such is the complexity of the schemes that are handled by Eugene J. de Sabla, Jr., the man who created the De Sabla power plant in 1903, founded the Nevada power plant near Nevada City back in 1895-6, and helped found and finish the great Colgate power plant in 1899.

Bull teams hauling machinery to build the De Sabla power house

Here is his story of why and how the De Sabla power plant came to be established:

"About the year 1903 the management of the Bay Counties Power Company realized that the capacity of its system, which then consisted of the Nevada County Power Company's plant on the South Yuba, near Nevada City, the Yuba Power Company's plant on the Brown's Valley Ditch, and the Colgate plant on the North Yuba River, was not sufficient to take care of the prospective business of the company in the territory it was serving.

"I therefore took up the matter and started on a tour of investigation to find out the best place to establish a new power plant that could be run in connection with the Bay Counties system.

"The Bay Counties Power Company had already acquired a water right on French Creek, a stream emptying into the Feather River at a point a short distance below the present power house of the Great Western Power Company at Big Bend.

"The superintendent of the Bay Counties Power Company at that time was L. M. Hancock, and his first assistant was T. E. Thebreath. On that trip to French Creek I took T. E. Thebreath with me.

"We then outlined a plan of development. It consisted of the building of a restraining dam in French Creek Valley. The restraining dam was to form a lake, which, to the best of my recollection, would have held about 500,000,000 cubic feet of water. The water from this lake was to have been taken through a tunnel. The tunnel was to have been constructed through the range of mountains separating the proposed lake from the Feather River. The tunnel was to have been about a mile and a half long. A pipeline about 6,000 feet long was to have been constructed. This would have given a fall of about 1,200 feet, and a capacity at the power house of about 10,000 kilowatts, or 13,400 electrical horsepower.

"We then formed the Butte County Power Company, with a capital stock of $1,000,000 and an authorized bond issue of $1,000,000 for the purpose of constructing this plant. The stock was to be owned by the Bay Counties Power Company, and the bonds were to be placed with some one of the bond firms.

"A camp had been started at French Creek, a lot of preliminary work had been done, roads had been built, and so forth. Practically all of the land in the reservoir site had been acquired, with the exception of

Eugene J. de Sabla, Jr.

one parcel. This unacquired area belonged to certain persons whom I knew personally and whom I had every reason to think would be friendly.

"I had practically placed the bonds with a San Francisco bond house. I then made a visit to French Creek to go over the proposed construction. While I was on the trip to the site the sale of the bonds was confirmed. I met the people who owned the small area of unpurchased land. It amounted to about one hundred or two hundred acres in the reservoir site, out of a total, which the reservoir would have covered, of about four hundred acres.

The main ditch that supplies the De Sabla plant with water power

There is more than fifty miles of this great aqueduct, traversing wooded ridges and flowing powerfully.

"These people then told me that they wanted $200,000 for their holdings, or half of the stock of the Butte Counties Power Company. It was about as artistic a holdup as I had ever encountered. My only answer was to call for T. E. Thebreath, who was in charge of the construction, and immediately order him to close down all work, discharge all the men, and consider the French Creek development as a dead issue. I then, in front of the persons in question, turned to the representatives of the bond firm and informed them that the deal was off as far as they were concerned, as the Butte County Power Company was a dead issue, due to the exorbitant price that was being asked for the one hundred or two hundred acres of land in the reservoir site.

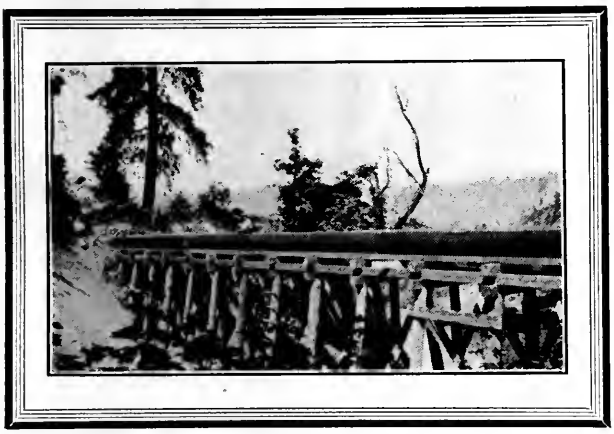
"Having in mind to purchase the water systems of the Cherokee Mining Company and also to purchase the Centerville plant, which was owned by the Butte County Electric Light and Power Company, I then formed the Valley Counties Power Company, with a capital stock of $2,500,000 and an authorized bond issue of $2,500,000. The bonds were to be guaranteed by the Bay Counties Power Company, and all of the business of the Bay Counties company in Butte County was to be turned over to the Valley Counties company, in consideration of which the Bay Counties company was to own all the capital stock of the new Valley Counties company.

"I therefore made arrangements and purchased the property of the Butte County Light and Power Company. Its holdings consisted of the now-existing Centerville Ditch,

which has since been enlarged, and a plant, having a capacity of about 1,000 kilowatts, with a pole-line to Oroville, where it had a contract with three or four gold dredges, and a pole-line to Colusa, where it had a contract with the Colusa local lighting system.

"I then purchased from the Melons of Pittsburg the entire water system of the Cherokee Mining Company, the principal value of which was that part of the system comprising the head-dam, located in Butte Creek, with a water right of about 4,000 miner's inches. The ditch was in comparatively good shape, but the flumes were so old that they were practically worthless.

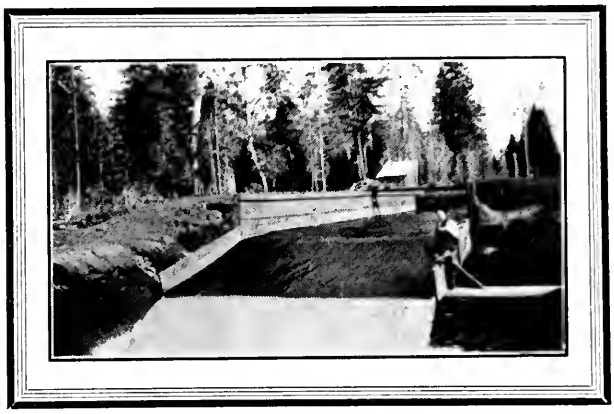
"While walking down the ditch for an examination of this system with T. E. Thebreath and R. L. Harter, the company's surveyor, we came to the conclusion that the best method of development was to divert the water at a point which used to be known as and may yet be called Slater's Dam; then to take the water by pipe-lines down a precipituous mountain-side to Butte Creek. We estimated there would be a fall of about 1,600 feet.



A bit of the De Sabla pipe line

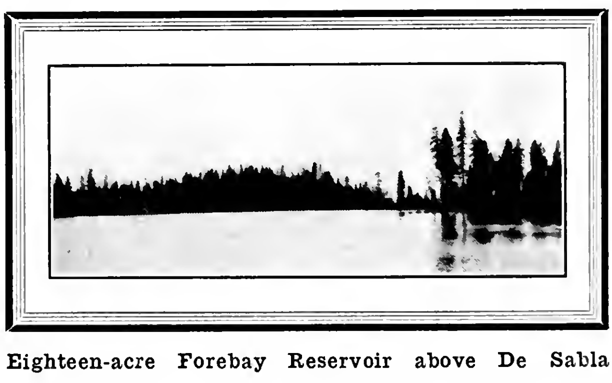
"From the top of the hill we could just about see the in-take of the Centerville Ditch on Butte Creek. We therefore realized that the water of the Cherokee system could be used over again by the Centerville system, thereby increasing very much the value of the property of the company.

"So we sent our rig, which had met us at that point, down to Centerville. After planning Slater's Dam and reservoir we started to go down the hill, looking for a location for the proposed pipe-line, with a view to finding out what kind of a place there would be on the edge of the creek below for a power house. When we finally got down there, at the bottom of a mile slope, we realized that we had a pretty hard proposition. It was nothing but rocks. Almost the entire area would have to be blasted out. But we decided upon a point at once and started a camp.



Hendricks Ditch emptying into De Sabla Forebay Reservoir

"In order to build the plant the first thing that I directed to be undertaken was the construction of the present road that winds several miles from the top of the hill down to the power house. All other parts of the work, from rebuilding the flumes and enlarging the ditches down to increasing the Centerville plant, were started simultaneously.



Eighteen-acre Forebay Reservoir above De Sabla

Camp One, near the reservoir, high above the De Sabla power house

"The first money was raised from a subscription by some of the principal stockholders of the Bay Counties Power Company. It was at a meeting held in my office in San Francisco, and $500,000 in bonds were taken by John R. Coleman, Theodore Low, R. R. Colgate, R. M. Hotaling, John Martin, William Pierson, and myself. After that the financing of the company was accomplished by the sale of the bonds to the general public.

"Inside of, I believe, one year the De Sabla plant was completed and furnishing current to its customers in Chico and in the Oroville gold-dredging district, and was delivering its surplus energy to the lines of the Bay Counties Power Company.

"Most of the construction was under the supervision of T. E. Thebreath. But toward the end of the work L. M. Hancock, the general superintendent, had charge.

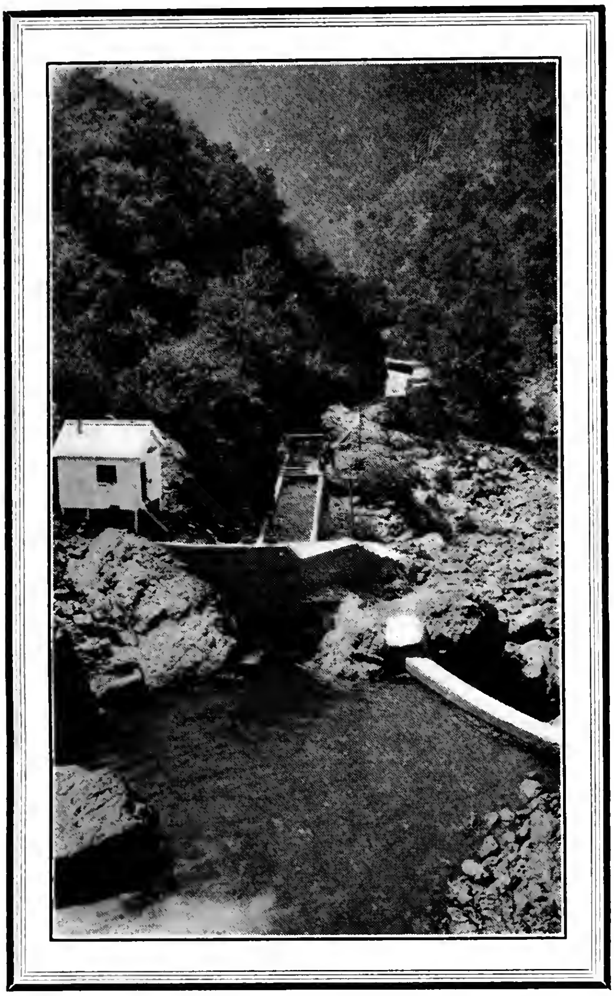
"To the best of my recollection, the distance between the head-dam of the Cherokee system and the penstock, or Slater's Dam, is about twelve miles, and the capacity of the ditch about 4,000 or 5,000 miner's inches.

"Since that time, however, there has been developed another water system called the Henderson Ditch, which is about twenty miles in length. It brings some of the waters from the west fork of the Feather River through a viaduct formerly owned by the Cherokee company and called the Toadtown Ditch. It joins the main De Sabla system at a point about a mile and a half above Slater's dam, thus practically affording the company a double water system.

"During the progress of the construction work, while I was in Europe, some of my associates named the plant after me, because of the part I had taken in the inception of the enterprise."

At first the De Sabla plant was referred to as the Nimshew power house. That was before it was officially named. Nimshew is a tiny hamlet up in the mountains a few miles from Camp One; it is the nearest postoffice to the power house. The Nimshew Indians,

now all extinct, used to occupy that part of California, and even down to the early mining days they controlled all the region southward to the American River.



Where the water is diverted from Butte Creek just below the De Sabla power house into the ditch leading down to the Centerville plant

Work did go with a rush on that De Sabla plant. There was blasting for the power house foundations, tunnelling down the slope for the pressure pipes, damming for the storage reservoir, and first of all the construction of that long winding mountain road down into the bottom of the cañon. The great pipes are anchored in cement blocks at thirty-three places, and one of these anchorages is a mass of masonry weighing one hundred tons. All these precautions had to be taken to insure rigidity, because the force of the downrushing water in those tubes is about seven hundred and fifty tons.

Twenty and thirty miles back in the mountains, through the primeval forest and its solitudes, come the great water ditches. They unite and pour their flood into the forebay reservoir on top of the ridge, a pretty, forest-skirted, artificial lake covering an area equivalent to about five city blocks. From that little lake extend the mighty pressure pipes that take the water down the mountain side to drive the De Sabla wheels; and later to batter against the wheels down at the Centerville plant.

The interior of the De Sabla power house is a model of simplicity, and its transformers

Looking down Butte Creek. The ditch to the Centerville power house skirts the left bank

and high-tension gallery have been considered the most perfect piece of engineering construction in California.

Coming down the mountain side through Indian Spring Ravine, close to the boarding

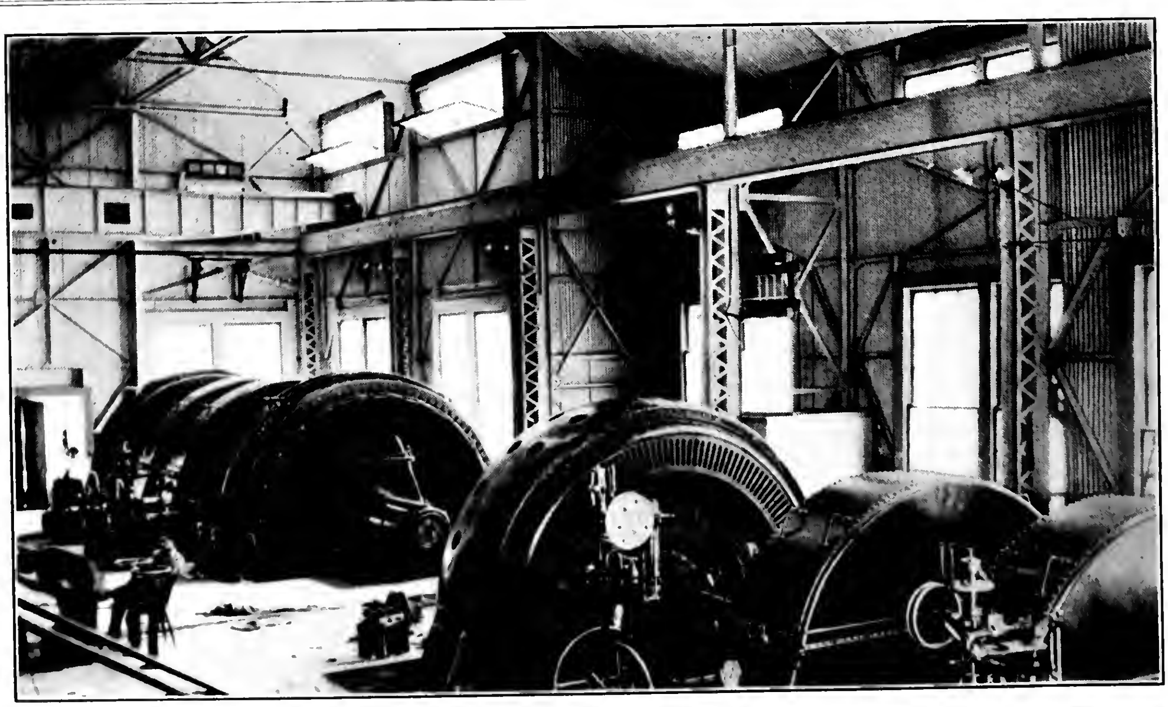
Flume on Centerville canal below De Sabla

Jack and Buck, the black mule team at De Sabla

house, is a rivulet that cascades and gushes and flashes its spray in the sunlight. That small creek is fed by several tributary rills. It supplies abundant water for cooling the transformers and the electrical generators and for fire purposes and the domestic needs of the little community that lives there hidden from the world in a wonderful beauty spot where day and night the dull roar of waters and machinery disturb the silent majesty of nature in one of her sublimest aspects.

There is that beautiful stream, gushing among mighty boulders. A picturesque suspension bridge extends from the clubhouse across the cañon to the wooded slopes and to winding pathways under sweet-scented foliage. In the water are trout. On those difficult slopes are just such haunts as deer most favor.

Some seventy feet up the hill above the power house are two large oil tanks, one containing oil for the transformers and the other the lubricating oil for the machinery and bearings. The fall creates a pressure and other devices increase it, so that oil is forced in everywhere to be sure that it penetrates well where speed is great and friction must not develop.



Generators in the De Sabla power house

August 22d, 1904, the fourth and largest generator was installed at the De Sabla power house. It is a great machine to produce 5,000 kilowatts. A new pipe-line was specially constructed parallel with the original one to drive the water-wheel that turns this powerful machine.

Early in 1906, after the amalgamated and augmented Bay Counties Power Company had become known as the California Gas and Electric Corporation, all its enterprises passed officially to the control and ownership of the Pacific Gas and Electric Company. In this transfer were involved the De Sabla and Centerville power plants, which are now part of the company's great hydro-electric system of eleven mountain generating stations and about one hundred electric distributing stations.

Comparatively few people will ever see the De Sabla power plant. It is difficult of access, isolated, apart. But its location is the most majestically beautiful place of all the spots where electricity is generated in California. As we rode up out of that cañon, the three silvery aluminum wires, thicker than a man's thumb, strung high overhead and pointing away to the southwestward, the thought came: if only more people down in the cities, those who use electric lights and enjoy the varied benefits of electric energy, could see this place and know something of the far-reaching waterways through the Sierra forest and the reservoir-lake and the pressure-pipe-lines, and that constant droning at the silvery building where water is doing the work of 17,000 horses, what an education it would be in the commercial development of natural resources, what a refining inspiration to gaze upon the varied beauties of that mountain scenery.

PHYSICAL DATA	DE SABLA PLANT	CENTERVILLE PLANT
Capacity of main storage reservoir	38,000,000 cu. ft.	same
Area of main storage reservoir	90 acres	same
Miles of main ditch and flume system	54.38	8.4
Miles of subordinate ditches and flumes	20	38.8
Flow the second in main ditch system	180 cu. ft.	190 cu. ft.
Pressure head (height of fall)	1,531 ft.	577 ft.
Force of water the square inch	664 lbs.	250 lbs.
Number of impulse wheels	4	1
Number of turbines	0	1
Capacity of generators in kilowatts	2,000; 2,000; 4,000; 5,000	900; 5,500
Total electrical horsepower	17,420	8,576
Generating voltage	2,400	2,300 and 2,400
Voltage on power lines	60,000	60,000
Altitude of reservoir	2,600 ft.	same
Altitude at power house	1,000 ft.	575 ft.
Size of power house	50 x 109 ft.	32 x 110 ft.
Material of building	Concrete foundation, steel frame, galvanized iron covering	Concrete walls, galvanized iron roof on steel frame
Plant placed in service	October 22, 1903	May, 1900

An Ohio concern is now successfully curing tobacco by subjecting it to the heat of a gas stove, and a man in Philadelphia has patented a device that subjects bundles of tobacco leaves to the X ray and thereby kills all the small bugs and insects with which tobacco leaves are infested. But the dead bugs smoke just as well as tobacco.

Some one has discovered that the shine may be removed from a suit simply by gently rubbing the shiny places with a piece of emery paper. The cure is not permanent, but is effective if repeated every few weeks. Now, ye office men of the shiny sleeve, cheer up and buy five cents' worth of emery paper.

It is not equally good for a shiny nose.

High-Tension Network of a Power System

By PAUL M. DOWNING, Engineer Hydro-electric Operation and Maintenance.

Paul M. Downing

The greatest incentive to hydro-electric development in California was the high price of fuel previous to the discovery of oil, as coal had to be imported from Australia and British Columbia and other localities remote from San Francisco as a shipping centre.

The unqualified success of the first polyphase transmission system in the world, that from Mill Creek to Redlands in California, a distance of sixteen miles, gave a great impetus to the industry. It was immediately followed by many other installations, each with its peculiar type of construction.

The great system of the Pacific Gas and Electric Company, now capable of distributing 137,500 horsepower, represents the consolidation of a number of plants. Some were early in line with this pioneer development. The result is that the oldest as well as the most modern apparatus is found in the present system.

The Colgate power house formed the nucleus of the present 60,000-volt network. It was the first to install apparatus to operate at that voltage, and, at the time, it was the largest and most important hydro-electric station in the northern part of California. The history of the Colgate plant is unique; its generators were installed, in operation, and overloaded before the construction work on the building was completed.

OPERATION

The Pacific Gas and Electric Company maintains fourteen power houses including the Colgate, of 14,200 kilowatt installation, the de Sabla, of 13,000, and the Electra of 20,000 kilowatts, all hydro-electric plants. It also has a 9,000-kilowatt steam turbine unit and a 12,000-kilowatt gas-engine plant. Included in its electric generating properties is the historic Folsom-Sacramento transmission of 1895.

All but one of the plants operate in parallel at sixty cycles on the 60,000-volt network of the Pacific Gas and Electric Company, which absorbs additional power from the 100,000-volt system of the Great Western Power Company, and the 60,000-volt lines of both the Snow Mountain and Northern California power companies. These interlinked systems, capable of distributing almost 200,000 horsepower, form a vast network composed of 1,820 miles of transmission line, of which 150 miles are of 100,000 volts fed by seventeen plants operating in parallel. The foregoing figures do not include many 11,000-volt lines that are considered as distributing systems.

It is worthy of note that the paralleling of these stations, the two most remote being separated by almost 400 miles of line and with widely varying loads, has been accomplished even more readily than though they were at the same point. Nor is it customary to do this paralleling at generating stations alone or on the low-voltage side of substations. It is done almost entirely on the 60,000-volt side, using transformers of relatively small capacity connected from line to ground for synchronizing purposes.

The governing and division of the load is effected easily by allowing any one station of sufficient capacity to carry the rapidly fluctuating load of the entire system by a sensitive adjustment of its governors, whereas they are adjusted more sluggishly in the other stations.

The apportionment of the load from the many stations to the lines and substations is handled in detail by the "Load Dispatcher," who has complete charge of the flow of water

from the lakes and reservoirs and in the flumes and ditches, as well as the starting and stopping of all generators and the division of power between them. In case of accident he has complete charge of re-establishing service. His office contains a mechanical model of the system, showing the stations, lines, and switches and where and when they are open or closed.

Although telephone lines are run on all transmission lines, they are not entirely depended upon, as they become useless when most needed. So wires are leased from the public telephone company, linking together all important stations and the dispatcher's office, by routes independent of the transmission line.

The operation of the many plants in parallel has the two-fold advantage that the regulation of voltage is easily accomplished and the capacity of the different stations can be utilized to the fullest extent. On the other hand, there is a distinct disadvantage, as the local trouble becomes general.

The inductive drop on the long lines forming a network of this kind is obviously high, especially where the induction motor load is heavy, and the synchronous motor load represents a very small percentage of the entire load. The wattless current, therefore, becomes quite a problem, and has to be taken care of either by distributing it among the different power houses, or by taking it entirely on a single station.

Troubles on long lines forming networks such as this do not always seriously affect the entire system, but show only as momentary drops in voltage. The generating stations are connected solid to the line, without circuit-breaking devices, and power is not taken off the lines unless it is impossible to keep it on. On the slightest indication of line trouble the system is immediately separated, leaving different sections or districts supplied from different sources. If the trouble be far enough removed from the generating station it will not be very severe, on account of the inductive and ohmic drop of the intervening lines. Generally operators have time to separate without more than a temporary drop in voltage. But if the trouble be near a power house that power house will be thrown out of synchronism with the system.

TRANSFORMERS—CONNECTIONS

The greater number of connections to the network are made by means of three transformers connected delta on the low and connected star on the high side. This, while having the disadvantage of throwing a dead short on the system when a wire comes down, has the advantage of giving a thoroughly positive indication of trouble. And that is almost indispensible within thickly settled communities.

Some occasional objection from the telephone and telegraph companies has proven unfounded. The trouble was traced to a static unbalance caused by an arcing ground on the line, and it would have been greater on an ungrounded system. This has been nicely shown by shifting the load, say 3,000 kilowatts, from three to two transformers of a bank, with practically no effect on the telephone service alongside.

The company's usual practice is, where one of three transformers in a bank at the generating end is out of service, to carry up to the capacity of the other two, or even to overload the two, making them carry the normal load of the three. It was not necessary to limit the unbalance of power delivered to the line in this manner. There should be no more hesitation in cutting a transformer out of a bank of three 1,500's than one from a bank of 100's. This condition also obtains in the case of step-down transformers.

When a load is small a customer is often supplied with two transformers or even one transformer, careful attention being given to the ground connection. The severe static strain on the secondary has at times caused

punctures, but the trouble being rare has not proven a sufficient cause for abandonment of the practice.

In the majority of installations the low side is also connected in star with the neutral ground for economic reasons. There is no operating preference between the star and delta low-side connection. The company had no trouble traceable to the particular manner of connection.

TRANSFORMERS—CONSTRUCTION

The capacities of transformers used range from 100 to 1,500 kilowatts. Most of them, except some of the smaller sizes, are shell-type, oil-insulated, and water-cooled.

The most satisfactory case for oil-cooled transformers is one of boiler iron mounted on a cast-iron base and having a cast-iron top.

The present tendency of manufacturers to cheapen high-voltage transformers by introducing pressboard or fibre-insulating barriers between coils in the place of micanite is to be deplored. Micanite will not absorb moisture, and, being non-inflammable, it will localize trouble and a burn out in one coil and seldom damage an adjacent one. Until a few years ago all of the transformers on the company's system had micanite insulation. The transformers would be received from the factory, and, without attempting to dry them out, they would be filled with oil as they came from the factory and put into service. It is now found necessary to dry them out thoroughly even after they have been standing without oil for ten days or two weeks.

Pressboard or horn fibre will absorb moisture in sufficient quantities to make it necessary to tear down a transformer in the event of a damaged water coil, or when handling transformers during rainy weather.

The oil also is being handled much more carefully than formerly, and separate samples taken from the different tanks in which it is shipped must be tested. If the dielectric strength be found to fall below a certain standard it is safe to assume that the low insulating qualities are due to moisture. This moisture can be readily removed by heating to a temperature slightly above 212 degrees Farenheit.

As to the relative fire risks of air- and oil-cooled transformers, I think that it is now generally conceded that the oil-type with a properly designed case is the safer of the two.

The greatest danger from an oil-insulated transformer is from fire external to the transformer itself, which might damage the case and allow the oil to escape.

In a number of instances there have occurred external fires which have heated the boiler iron to such an extent that the oil has been badly carbonized and the point on the inside of the case burned entirely off without damage being done to the winding.

It is wrong to sacrifice reliability to cost, as the transformer must bear the burden of taking care of high-voltage line disturbances. For this reason the three-phase transformer is at a disadvantage, as trouble on one phase would entirely interrupt service, unless a spare transformer were installed.

SWITCHES

Outside of the lightning arrester or line discharger for taking care of high voltages high tension switches were probably slower to develop than any other piece of apparatus used in connection with long transmission lines. It is only during the past few years that there have been any high-tension switches on the market, but there is now a number of different designs, all of which have generally proven satisfatory.

The system of the Pacific Gas and Electric Company was one of the first to use oil switches for voltages in excess of 40,000. As early as 1900 this company built and put into operation switches which were of practically the same type as are now being used. While the switch was still in the experimental stages the framework supporting the tanks

was of wood and the tanks themselves were the ordinary fibre or paper mache tubs, such as are used for laundry purposes. Switches of this kind served their purpose well. They are even now still in use after years of service. But where they are called upon to break heavy loads, such as come on at times of short circuit, they are apt to throw the oil out of the container when operated.

To overcome this trouble we have designed a four-break switch along practically the same lines, but with a considerably greater depth of oil over the contact. This type has been in service in some of our largest power houses for several years. They have never failed to open the lines under all conditions of short-circuit.

The particular features of this switch are: first, the absence of any insulating material that might become saturated with oil and catch on fire, either from leakage or from an arc; second, the insulation of the switch from the ground, thereby affording the greatest protection against breakdowns due to surges or other high-voltage disturbances, when the switch is open; and third, a constant depth of oil over the contact at all positions of the blades.

LIGHTNING ARRESTERS

Except in the higher mountain districts the Pacific coast is comparatively free from lightning, and we make no attempt whatever to protect against lightning disturbances.

In the earlier installations practically every type of multigap arrester was tried. They proved a menace rather than a protection. So they were discarded, and simple double-horn arresters to ground, set at about twenty-five per cent. above normal voltage, have been used with satisfaction. These are used more on account of their being voltage-limiting devices than otherwise. Discharges over these arresters always cause a drop in voltage, and very often a momentary interruption to service until the arc breaks. We do not install them at every station, but only at the power houses and at more important stations where heavy switching is done.

INSULATORS

On the system of the Pacific Gas and Electric Company the puncturing of insulators is infrequent. But leakage over the surfaces causes more trouble during the dry season than in winter. This condition is traceable to the deposition of dirt and to salt carried by ocean fogs. Troubles are frequent when this deposit becomes moistened by the first rains. But such trouble seldom occurs after the winter rains have thoroughly cleaned the insulator surfaces.

Often 60,000-volt insulators, whether on wood or steel structures, fail to insulate on 11,000-volt lines at certain points where they are severely exposed to ocean fogs, dust, and smoke, particularly in the district about San Francisco bay.

It is necessary in the foggiest localities to cut out a line and, as often as twice a year, carefully to wipe the under part of the insulators that are not exposed to rain.

The suspension-type insulator has a decided advantage in this respect. But the much higher voltage to which they are exposed makes it necessary eventually to employ the same homely means of preventing leakage.

With wooden poles the top is burned off and the insulator is seldom damaged. But with all iron structures the arc often demolishes the insulator, and sometimes it severs the line wire.

By an agreement effected early in February between the carmen and the company the 175 operatives on the street-car system at Sacramento receive an increase of approximately nineteen cents a day. The first-year men will hereafter get $2.75 for a day of nine and a half hours, the second-year men $2.85, the third-year men $2.95, and the men who have served four years or longer $3.04.

Electric Transmission Troubles

By C. F. ADAMS, Engineer Electric Construction.

PART III

C. F. Adams

For commercial power wo the motor generally employed is the induction motor. The design of this type of motor is so simple that the troubles experienced are generally due to mechanical causes and overload. The running clearance of the induction motor is small, and the wear on bearings or shaft must be compensated for by adjustment. The air gap is sometimes completely closed by dust, as in cement mills, and the removal of the rotor then becomes a difficult matter.

The direct-current motor is largely confined to car and elevator use. On nearly all standard apparatus of this class, the operating troubles have been practically eliminated by careful factory design and construction. Sparkless commutation, carbon brushes, and moderate operating temperatures have corrected most of the former troubles. The use of kerosene oil as a commutator cleanser is recommended in place of vaseline or some other heavy lubricant. A proper carbon requires no lubrication, and the less "dope" used on a commutator the better the results.

Transformers are a class of apparatus in which the service of an attendant is generally limited to maintaining a constant supply of cooling water and an occasional inspection of the oil to detect the presence of water in the oil. The major part of the power house and substation power transformers are of the water-cooled type. These cooling coils, of iron, brass, or copper, are much affected by the presence of mineral or sediment, carried by the cooling water. The precipitation of such matter is dependent on the water temperature and on the rapidity of circulation. With slow circulation and hot discharge water, the coils will close up from sediment in a short time when the water is bad. Where the cost of water is not an item, its free use is desirable. Where water is limited and expensive the best results are obtained by using a cooling tank of some form and a circulating pump.

Concerning transformer oils and the details of transformer construction much can be left unsaid. The construction details are largely dependent on the caprice of the factory economist. The only argument that impresses and retards this destructive individual is the cost of replacement of apparatus that fails in service. "Let the buyer beware" is a motto especially applicable to the purchaser of electrical apparatus.

Ten years' operating experience has demonstrated that a thin, fluid oil containing almost no vaseline is best adapted for use in large transformers. The oil serves as an insulator and also as a cooling medium. The heavy oils tend to solidify after long use, and thus close up the circulating channels past the coils. Manufacturers have learned that lower operating temperatures can be maintained with the thin oils, and are now recommending this grade of oil for all power transformers.

The earlier transformer builders relied on very extensive solid insulation over the coils. Unable to dissipate their heat these coils shortly burned up. The manufacturers charged the trouble to the type of oil and raised a cry about low "flashing point," fire risk, et cetera. The grade of oil was changed to a thicker oil of high flash-test, with no improvement in the life of the transformer.

After some years the idea finally penetrated that the oil itself should come in direct contact with the windings in order best to cool and insulate the coils. Now the subjects of "flash point," et cetera, are no longer discussed and the old grade of oil, condemned

some years ago, is now recommended and used everywhere. Time has thus vindicated the consistent policy of the Pacific Gas and Electric Company in regard to transformer oils.

The presence of moisture in oils, methods of removing the moisture, and the maintenance of the highest dielectric strength are all important. The use of insulating materials, capable of absorbing moisture, has been a step backward. The use of this class of material has been defended by the manufacurer on the ground of lower cost; that a first-class article could not be sold in competition with cheaper goods, and so on. High profit can always purchase an able defense. The demands of the public for first-class, uninterrupted service will be the final argument and will result in higher-grade apparatus.

(To be continued.)

Shop Practice

By I. A. ROSEVEARE, Machine-shop Foreman, Sacramento Supply District.

I. A. Roseveare

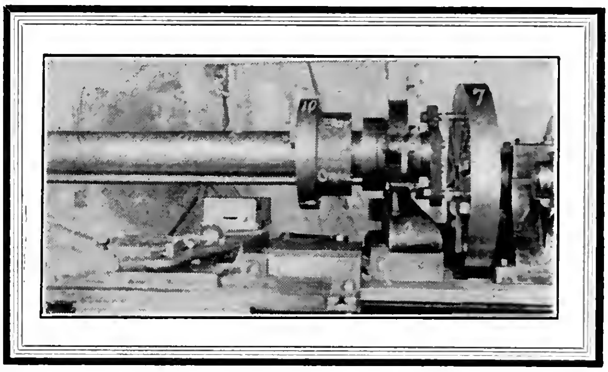
In a brick building within the grounds of the Pacific Gas and Electric Company's gas works on the river bank at Sacramento is kept a large variety of electric construction supplies for use in the tributary country to the eastward. And a considerable part of the building's area is occupied by a repair shop.

Not only are appliances and parts of machinery repaired there but some devices are actually manufactured on the premises.

Much work is done in repairing large transformers, Lombard governors, gas engines, water wheels, and other metallic mechanisms. Occasionally a job requires machinery larger than that installed in the shop. Then the work is sent out to a larger commercial shop, or temporary alterations are made in some of the existing tools to fit them for the bigger task.

The accompanying illustration shows a twenty-four-inch lathe that we rigged up to bore a cylinder with a maximum diameter of twenty-nine inches for the Alta power house. The figures marked on the picture of the lathe will make references to the parts easily comprehended.

This lathe is motor-driven, and consequently it is impractical to raise the headstock (1) or the live-centre (3). The tailstock and steady rest (2) were raised 3¼ inches above the live centre (3) with the piece marked 9. A brass bush (4) was provided in the steady rest (2) for the traveling head-bar (5), and two driving pins (6) were fastened to the bar.



Although the face-plate drive could have been cam-shape, we used a straight bar drive (8), which gave good results.

The traveling head (10) was used in boring the hydraulic cylinder for the Alta power house, and then it was converted into a stationary bar (5) in making a bearing for the Folsom power house. Thus double results were attained over a portable boring device such as is used in railroad shops.

The traveling head-bar had previously been made for boring a cylinder of the eighty-horsepower gas engine in operation at the Sacramento gas works.

The Alternating-Current Wattmeter

By J. U. SMITH (M. Sc.), Draughting Department.

J. U. Smith

The alternating-current wattmeter is given a very intricate and involved problem to solve. Yet its mechanical construction is so simple that one must wonder after all how it can perform its remarkable function. Like the direct-current wattmeter, this instrument is assigned the task of measuring the power delivered through a given electric circuit. It is expected to measure this power correctly with favors to no one.

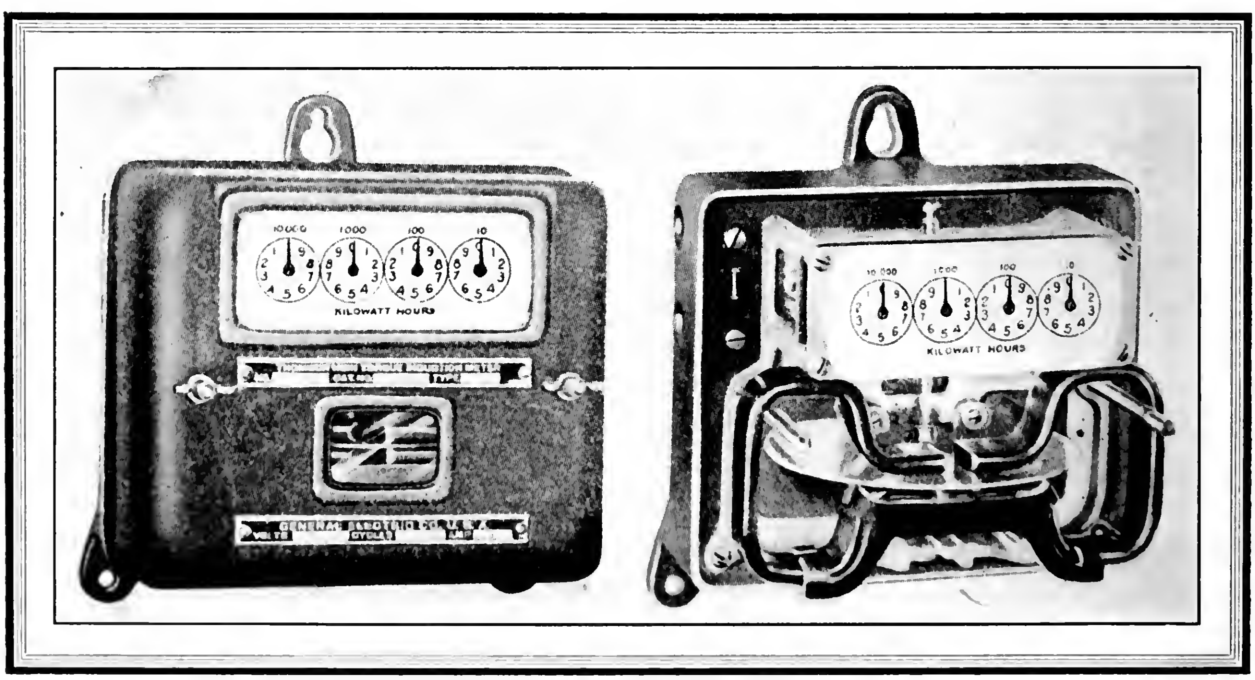
The unit of power here used is the kilowatt-hour. It is about the amount of energy consumed by twenty-five sixteen-candle-power electric lamps when burned for one hour. In round numbers it is the power required to lift 44,000 pounds sixty feet in an hour. It is about one and one-third horsepower for an hour.

There are three general classes of wattmeters: the indicating, the curve-drawing, and the integrating. The first indicates, by means of a pointer moving over a scale, the rate at which the power is being delivered. But it does not indicate the rapid fluctuations of power caused by the alternations of the circuit; these fluctuations it averages.

The curve-drawing meter is similar to the indicating meter in its general workings. But instead of the pointer on a scale there is a stylographic pen attached to the movable arm, and this pen records by drawing a curve on a band of paper that is moved under it by clockwork. The paper is previously divided lengthwise by vertical lines, making the hour and fractions; the units of power are similarly marked off by lines in the other direction. By examining this curve it is possible to determine what the power rate was at any desired hour of the day.

The third class, or integrating meter, adds up the power delivered and indicates the sum total from the last setting of the instrument.

Indicating meters are placed on generator circuits to indicate what load the machine is



The Electric Wattmeter, with and without the front cover

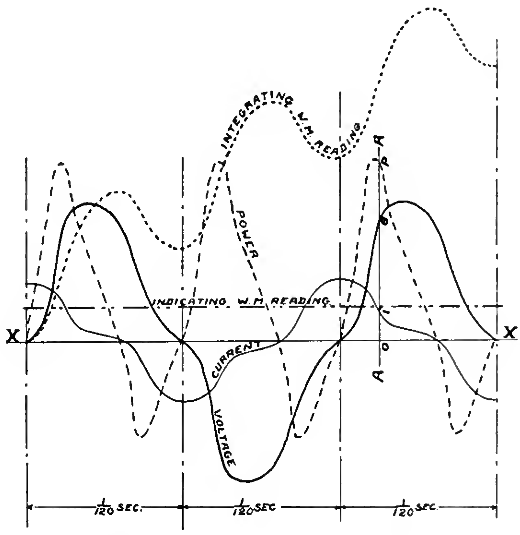
carrying. Curve-drawing meters may be placed on any circuit when it is desired to determine the rate at which power is being delivered to a particular circuit at different hours of the day. On its reading is determined sometimes the price a kilowatt hour to be charged a customer. If his power consumption be confined to hours of the day during which comparatively small demands are being made on the system the electric power company can afford to ask him a lower price than if he took the power when the system was being heavily taxed to provide maximum demand for energy.

The integrating meter is the one by which all bills are determined. It is used on every customer's circuit, whether for a flat, burning a few incandescent lamps, or for a street-railroad sub-station, consuming its thousands of kilowatts an hour.

In the measurement of electric power, either with alternating current or direct current, two factors enter. These factors are the pressure (expressed as so many volts) and the current (referred to as amperes).

It is a fact well established by experiment and accounted for in theory that the power is proportional to the product of the volts and amperes. As an illustration of this: a 220-volt lamp on a 220-volt circuit takes the same power as a 110-volt lamp on a 110-volt circuit, provided both lamps are of the same candle-power and efficiency. This is seen to be true when we consider: first, that being of the same candle-power, the amount of power converted into light energy is the same for both; and second, one lamp becomes as hot as the other, the power converted into heat energy becoming the same for both. There fore, as the whole power taken by each lamp is converted into these two forms of energy, light and heat, and the light and heat of one lamp being equal to those of the other, their sum, which is the whole power consumed, is the same in each case.

The wattmeter must, therefore, automatically multiply the current by the pressure. On alternating circuits this is a lively task, for both voltage and current change from full amount in one direction to full amount in the reverse direction one hundred and twenty times every second. Look at the curves of current, pressure, and power in the accompanying figure. These curves are for an



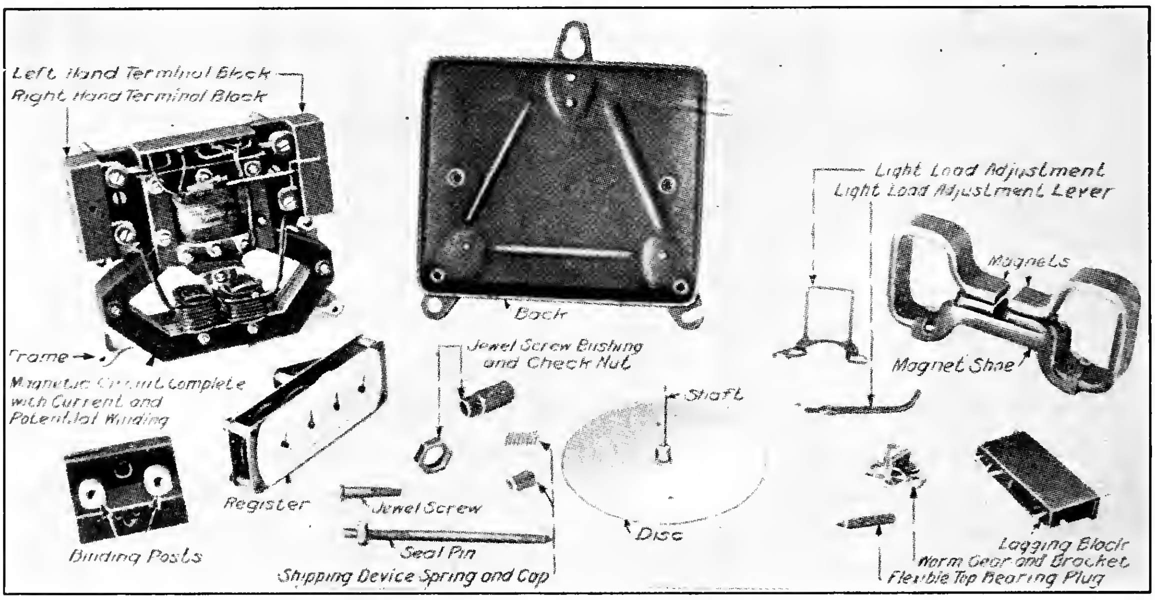
assumed but possible alternating current of sixty cycles, or a current reversing one hundred and twenty times a second. Line xx is the zero axis, and the vertical lines at regular intervals are spaced one-one-hundred-and-twentieth of a second apart. So that the curves between alternate vertical lines will each represent a complete cycle of values. The distances *oi*, *oe*, and *op*, cut off on a vertical line AA, cutting the curves, will represent respectively instantaneous values of current, pressure, and power. Now as line AA is moved along the curves an infinite number of values of current and pressure are found. Also it is noted in this assumed case that an interval of time elapses after the voltage crosses the axis before the current makes its crossing. In this interval the signs of the two factors are opposite and therefore the product, that is the power, is negative. This means that during this interval (and one occurs during part of every one-one-hundred-and-twentieth of a second) the circuit is actually pumping power back into the line.

Therefore we find the loops of the power curve below the axis.

The wattmeter must then take the products of each of these infinite number of pairs of values and, after multiplying each by its infinitesimal interval of time, in order to reduce it to kilowatt-hours, it must add the products and, by moving its pointers over their respective units, tens, hundreds, thousands, it must indicate the proper sum total which has passed since the instrument was last set. So with the electric wattmeter. It measures power, which means the actual work done.

In considering the mechanical construction of the meter, reference will be made here only to the induction-type of meter.

The driving mechanism consists of a light, circular disc about one-sixteenth inch thick, by four and a half inches in diameter, secured at right angles to a shaft. Through this shaft and a train of gearing the motion is transmitted to the pointers of the registering mechanism. Three electro-magnets are arranged, two below the disc and one centrally over these above the disc. All are perpendicular to the surface of the disc and near enough to give a good working clearance. The lower magnets are wound with but a few turns of large wire, through which the current of the circuit is led in such a way as to magnetize them oppositely. The upper magnet is wound with a great many turns of fine wire and this is connected across the circuit. It therefore is effected only by the pressure, or voltage, of the circuit.



Showing Various Parts of the Electric Wattmeter

When consideration is given these facts, it is seen that the little black-cased instrument which is fastened out on our back porch up among the cobwebs, is assigned a task greatly exceeding in difficulty that assigned to any other commercial measuring instrument known.

The water-meter and the gas-meter each measures volume only, no account being taken of the pressure or of the quality. The water may not be fit to drink and the gas may be either good or bad, but the meter for each runs on as jauntily as if the article delivered was of the finest imaginable quality. Not

A magnet constructed in this way is slow

to magnetize and demagnetize, so that with an alternating current the magnetism lags behind the voltage. In fact this magnet is designed to make this lag practically one-fourth of the wave length. This is not true of the current coils. Owing to the small number of turns the lagging effect is very slight, so that the magnetism is practically in unison with the current.

For a sixty-cycle circuit, that is, one which is reversing one hundred and twenty times a second, and one in which the current is practically in step with the voltage, we get the following relative relations between the magnets:

N standing for north polarity, S for south polarity, and O for demagnetized condition; also let A be the left-hand lower magnet, B the lower right-hand magnet, and C the upper magnet.

POSITIONS	MAGNET A	MAGNET C	MAGNET B
1st	S	O	N
2d, ¼ cycle later..	O	N	O
3d, ½ cycle later..	N	O	S
4th, ¾ cycle later..	O	S	O
5th, 1 cycle later..	S	O	N

Here it is seen that during each cycle, the effect is produced of a north magnetic pole moving from left to right, followed by a neutral pole, and then by a south pole. These traveling pole effects induce whirls of current, called eddy currents, in the part of the disc under them, or over them, as the case may be.

In turn these eddy currents are attracted by the magnet which induces them, and as a result the disc rotates and tries to keep up with the traveling poles.

If nothing more were added to effect this speed there would be no resistance to this movement other than that caused by friction in the bearings and gearing. But this friction is a quantity which, in spite of jewel bearings and good workmanship, varies greatly as the meter is used. To neutralize this varying resistance to such an extent that it may almost be forgotten use is made of a very ingeneous device. In the first place the magnets are so designed that, compared with the friction, a heavy pull is exerted on the disc, and, to overcome this, a retarding device is added which acts proportionately to the speed, but is not expected to change with time. Thus the friction is made to assume but a comparatively small part in the total retarding effect, and therefore any changes likely to take place in it are of little consequence.

This retarding device consists of permanent steel horse-shoe magnets. They are so placed that the poles of each are one above and one below the disc, but not touching it. Just as the disc is rotated by the attraction of the traveling poles for the eddy currents induced in it, so its motion is retarded by the attraction of the permanent magnets for the eddy currents which they also induce in the moving disc. And the retarding effect of these magnets is proportional to the speed of the disc, starting at zero with zero speed. In the same way the pull on the disc produced by the alternating-current magnets diminishes as the speed increases. It would be zero if the disc moved as fast as the traveling polarity. So, for each value of the load, a speed is found at which the total retarding effect is just equal to the driving effect, and the disc revolves along happily at this speed until a change in the load takes place. Then it immediately finds a speed which will satisfy the new conditions.

Other devices are added to compensate for different effects, to regulate the speed of the meter, and so on.

The recording is done by four pointers, each on a dial marked with the ten figures, 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. The pointers indicate from right to left the units, tens, hundreds, and thousands of kilowatt-hours.

The wattmeter here described, though having a very intricate and in itself difficult task to perform, is almost severely simple in its mechanical construction. It is safe to say that it is the result of some of the best thought of many very ingenious minds.

Pacific Gas and Electric Magazine

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EDITORIAL

The City Man's Vacation

The call to the country, the return to nature, the freedom of the great outdoors. This is the season. The summer vacation feeling is stirring in the cities. Man is a migratory animal. Conditions of life keep most of us pretty close to the job. Those that have means and leisure travel afar. The Arabs, the Persians, the Tartars are nomads. The gypsies of today are remnants of that old unrest, the spirit that impels to move on from place to place. The tramp, freed of responsibility, unambitious, lazy, moves on and on.

The Norsemen of a thousand years ago had the hardier adventurous urging to go far upon the uncharted sea and explore. Columbus had that longing. And so through the list of all the world's adventurers and explorers and the discoverers of new lands and new waterways.

The railroad has made the travel lust easier; automobiles have created a thrill for new scenes, for exploring the countryside.

But the great mass of the people must of necessity have more modest desires. There is not the money; the size of the family often precludes an expensive trip. And so it comes —the vacation in the conveniently near country, the camping-out, the relaxation from the confining environment and the noise and exactions of city life.

There are no hermits in big cities. But man can live close to nature and manage to exist apart from his fellows. There is a freedom, a naturalness that no city life can create. The high walls, the confined streets, the rush of traffic, the din of vehicles and mechanics,—they get on the nerves; they produce an unconscious tension. People do not realize it, but the harvest of nervousness and nerve diseases is disproportionately large in the crowded cities and significantly small in the country. Have you ever known a man dweller on the deserts of Nevada or Arizona who was not won by the indefinable something in the boundless freedom and quiet of the place?

Few other great cities of the world have wild country and rugged and bowery nature so close at hand as have the communities about San Francisco bay. Down the peninsula are wooded dells and cañons. Up in that fair country stretching northward beyond the looming peak of Tamalpais are beauty spots along the timbered shores of the picturesque Russian River, that fairy-land where the Bohemian Club has its majestic grove and holds its world-famous Midsummer Jinks. All through Sonoma and Mendocino and Lake Counties hunting and fishing and camping invite, and the campers go. Further up in that fair redwood country the more venturesome penetrate and get the rewards of plentiful game, deer and bear, in the wilds of Trinity County, where lack of standard transportation has kept the Pitt River and its trout-filled tributaries almost an untouched wilderness, a country where land with natural springs, timber, and altitude insuring summer coolness is there waiting, a lot of it a $7 an acre. You who go forth to summer vacations, to camping, to hunting, just think of these chances and consider if they will be as easily available ten, fifteen years from now. Transportation will come, and commercialism, and the chance of wild rural freedom will merge into the conventional hotel.

A rural vacation is rejuvenating.

MEN OF THE COMPANY

WILLIAM BRADFORD BOSLEY

School Teacher, Yale Man, College Professor, and Corporation Lawyer

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THE general attorney of the Pacific Gas and Electric Company was born May 9, 1865, in the town of Livonia, Livingston County, New York. He received his early education in the public schools and prepared for college at the state normal school in Geneseo, New York, where he graduated in June, 1888. Prior to his graduation he taught in the public schools of New York state for approximately three years. He entered Yale University in September, 1888, and graduated with the degree of Bachelor of Arts in June, 1892.

He studied law at the Yale Law School, and received the degree of Bachelor of Laws in June, 1894, and immediately thereafter was admitted to the bar in the state of Connecticut. In college he was a member of the Psi Upsilon fraternity and of the legal society Phi Delta Phi.

He came to California in September, 1894, where he has ever since been engaged in the general practice of law in San Francisco.

William B. Bosley

During the period commencing with the beginning of the college year 1895 and ending with the close of the college year in 1899, he was assistant professor of law in the Hastings College of the Law in San Francisco and lectured on the law of real property, the law of agency, partnership, and corporations, the law of evidence, and constitutional law. During the college years of 1901-2 and 1902-3, he gave a course of lectures on the law of property in the law department of the University of California at Berkeley.

He has been in charge of the law department of the Pacific Gas and Electric Company ever since its incorporation in the autumn of 1905.

He is married, has a son and a daughter, and resides in San Francisco.

G. E. Snow of the Stockton Water Company has a little son born at Stockton May 23d.

Why Gas Causes Moisture

By GEORGE FURNISS, Assistant Manager, Oakland District.

George Furniss

Moisture from gas is frequently urged as an objection to the use of the gas stove. People will assert that gas will cause the wallpaper to peel, that it will tarnish metal and silverware, and that it will produce mildew on highly polished furniture. But this moisture is no more than the law of nature.

Water is a product of all combustion, be the flame from a coal fire, a tallow candle, or a coal-oil lamp. Hydrogen is a part of all fuel. In the process of burning, the liberated hydrogen unites with the oxygen of the air, forming water (H_2O). When water is separated it breaks up into two gases, into two parts hydrogen and one part oxygen.

The coal-stove would cause this same deposit of water were it not for the smoke which compels the use of a chimney, and the chimney, creating an upward draught, draws up smoke, moisture, and fumes. The gas-stove should likewise have a chimney. But the gas man has endeavored to make an appliance adaptable to any location, regardless of chimneys, and also to give the maximum amount of heat. Should the gas flames be inclosed in an iron case, such as a coal stove, then all that iron would absorb heat. To avoid this waste of heat, and for quickness of action, the flame of the gas range is thrown into direct contact with the utensil, or directly upon the article to be cooked, as in the oven.

Likewise the gas flame of the radiator is burned in direct contact with the air of the room. The gas range is provided with a blue flame caused by the Bunsen burner, so named from the noted man who discovered the principle of providing an opening in the burner whereby the pressure of gas draws in air and causes a mixture of air and gas before the ignition. The intake of air in the Bunsen varies in ratio to the pressure of the gas and the size of the air opening; about seven parts of air and one of gas make the ideal flame. The air feature also converts each flame into a blow-pipe by concentrating the heat to a small point and thereby lessening the loss of heat from radiation.

In the radiator-stove for heating a room or in the gas log using asbestos the flame is made luminous. This is because light radiates down as well as up. This radiation tends to carry heat in all directions, whereas the Bunsen, or non-luminous flame, concentrates the heat in one general direction, naturally upward. But there is no difference in the intrinsic heat of the two flames. These conditions tend to expose the flame directly to the air. Hence, in the process of combustion, moisture is liberated in the room.

One hundred cubic feet of gas in combustion will form six (6.05) pounds of water, or the equivalent of six pints. Hammam bath! No. It takes many hours to consume one hundred cubic feet of gas, and it also takes 7,680 drops of water to the pound, or pint. During the long intervening period the air is given an opportunity to draw off the moisture.

When air contains all the moisture it can hold it is said to be saturated. This condition is called 100 per cent. of humidity. When air becomes full of moisture it is said to have reached the "dew point." That is, the point where dew or moisture will be deposited when the air strikes colder substances. Cold air requires less moisture to become saturated than air which is warmer. Thus one hundred cubic feet of air at 50° will hold 409 grains of water (about a grain to the drop); at 90°, 1,481 grains; and at 100°, 1,979 grains.

The weather reports in the daily papers show the relative humidity of Red Bluff and

Fresno, contrasting altitude with sea-level. During the summer season Red Bluff will show about 23 per cent. humidity and Fresno about 30 per cent., with about the same average temperature. In winter, when not raining, the humidity at Red Bluff will range about 48 per cent. and at Fresno about 77 per cent. Oakland will show a yearly average humidity, or air moisture, of about 80 per cent., due to mild climate and proximity to the sea. In other words, Oakland, with an atmosphere charged four-fifths with water vapor, will have more moisture troubles from gas stoves than places remote from the sea coast.

Ventilation, then, is the solution for moisture. Open the windows to produce circulation of air. It is better for the health, and it is good for the gas.

The gas portable radiator is only a makeshift, and it should be sold only with that understanding. The gas log of the Backus and Garwood types, placed in a recess with a flue, is an efficient small heating installation, just as the modern hot-air gas furnace is efficient for more pretentious comfort. For the kitchen the gas-range and the water-heater should be supplied with vents, or small chimneys, and a canopy-hood should be placed over the stove. If no hood be provided, then there should be a small overhead opening in the ceiling, with a trap door, unless there be nearby windows. The kitchen walls should be plastered and painted, both for sanitary reasons and for gas considerations. Wall-paper is manifestly unsanitary, yet in years gone by gas companies have paid to have kitchens repapered to appease customers because the paper puckered up and peeled off from moisture that had no escape.

The moisture criticism is but a minor consideration when all of the conveniences of gas are considered. Gas is always ready, clean, and quick. How, after experiencing the taking down and cleaning of a coal stove, the packing of coal and ashes, the building of the fire, and the wasted and unnecessary heat, one can continue with these methods is hard for the intelligent gas-user to understand. The coal stove argument is that it provides house heat. If you want house heat, install a small, air-tight, drum stove, the kind that uses but little fuel and gives the maximum of heat. In fact, a drum stove has been improvised with an inclosed gas burner, and it gives good results. Such a heater and a modern gas-range for the cooking will cost less money for fuel and save a lot of drudgery and dirt. Then again the argument is that the coal stove furnishes plenty of hot water. Take out the water back and note the great saving in fuel. The tea kettle on the gas-range will give hot water quickly. The gas-circulating water-heater will give quantity for far less cost and in much less time. The automatic water-heater is more pretentious.

After all consideration, the gas man will find that he has a good commodity. The sooner he thoroughly realizes this, the greater will become his zeal, and it is this very zeal which makes complaint work easy and gets the new business.

O, the world's a curious compound, with its honey and its gall,
With its care and bitter crosses; but a good worl' after all;
An' a good God must have made it—leastways that is what I say
When a hand is on my shoulder in a friendly sort of way!

Thomas Price and Sons, the well-known analytical chemists and assayers of San Francisco, have made detailed analyses of samples of water from the deep wells with which the Pacific Gas and Electric Company supplies the city of Stockton with all its water. Their report concludes with this summary: "Both samples of water are free from injurious organic and inorganic substances. They contain no pathologic germs; they are moderately hard waters, but are well adapted for general domestic purposes."

Making Statistics Useful

By ERNEST B. PRICE, Statistician, Operation Department.

Ernest B. Price

Looking for leaks is part of the business detail of a great concern like the Pacific Gas and Electric Company. And to find those leaks daily records are kept and from them statistics quickly worked out that will show just what each electric generating plant, each gas works, each substation is accomplishing with the material it is using.

It is not sufficient, for example, to infer that because John Doe has been a fireman all his life he must be operating his boilers so as to get their maximum efficiency. So much fuel should make so much result. Everything is reducable to close averages. And if the veteran and experienced John Doe is not getting the results reasonably expected an analysis of the flue gases may develop the fact that he has been unknowingly sending a goodly sum of the company's money up the smokestack in the form of unburnt fuel-oil.

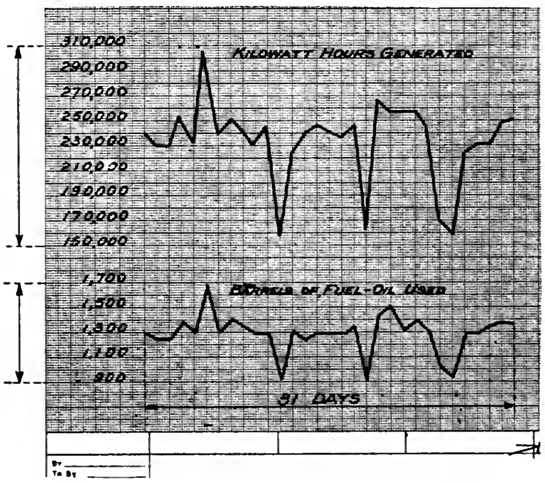
The word statistics usually makes the average person sigh and suppress a yawn. He pictures dry figures spread out in masses, and would about as soon study the little meshes in an ordinary window-screen. But a big business concern does not compile statistics for the fun of the thing or merely for scientific reasons. They are secured and studied and promptly converted into a standard form in graphic line or diagram to show at a glance the condition; to tell whether or not any plant or part of a plant is running at a profit or causing a small loss. And little, unnoticed losses in the aggregate are the things that in a big concern finally bring on financial failure.

The statistical bureau must discriminate between valuable and useless figures, and must analyze the operating data and get them into form soon enough to make them valuable in quickly locating some evident defect that is cutting into the profit column.

Efficiency records are kept all along the line and for varying conditions of load, not for their scientific interest but for their relation to dividends.

Every power plant and gas works is a factory, and each one must turn out its product at a cost that will insure a profit on the investment; otherwise the venture is a commercial failure.

Good results can only be obtained through the hearty cooperation of the chief engineer



of the plant, the man in the fireroom, the man in the engineroom, and the man at the switchboard. If any one of these human factors be at variance with the others the resulting efficiency of the plant suffers.

Apparently insignificant leaks run into alarming figures when developed to a yearly total, and when that total is multiplied by the number of power houses or substations the final amount assumes alarming size.

All the figures and charts pertaining to the operation of the plants come within the scope of the statistical organization. The usefulness of the statistics depends largely upon the

skill of the man who interprets them and can promptly detect from the daily reports any abnormal condition of operation and reveal them at once for the inspection and treatment of the chief engineer of the department affected.

Thus it is that a large concern, combining a number of plants of ordinary size, is able to bring to its aid the perfection of system and the skill of engineers that no one plant could afford. And by doing this it can get better results for its stockholders and for its customers than could be obtained with each plant operating as a separate property. But unless the men know how, it is easy to lose a lot of money in the business. That is why it is a risky thing for any politically-run city to tackle.

An Unedited Letter

YOURS of 18th received and contence noted.

In reply would say that never had any Service of any kind nore had any indebted to you any for or kind. Do not owe any bill amounting $40.00.

Have no words nore words to term the imposetion which hed your office in ——— had preferred on us. We think it just as bad as a calamity that Should come on us. your office in ——— a young fallow would not leason any reason but pore on us all kinds of insult. Had truble enough and we Surly will protest further truble on this unjust bill that had made against me.

This is the pure and Simple. We had used gess in Los Angeles for Some time and our gess bill never run over two dollars but mostly our gess bill amounted $1.30 to $1.50 month. We moved to ——— last Oct. and rented this present house $16.50 a month. and depositing $2.50 a metter had placed for this house for our use. we are four in our family Oct. month our bill (without 16¾ diccout as we did not know that we had to go to office and pay within ten days of each month,) amonted $1.50. Nov. month run up $3.90. the we told collector that our Gess bill never so high. no month we shall be careful So would not run so high.

Have been waiting for the collector to come for our Dec. bill, It was a great Surprise when a bill of $21.60 presented for Dec Gess bill at once I went to your office and told them there must be Surly a great mistake and told them to take your metter out and found out where mistake is made next day being Saturday could not go on Monday went out and could not hear but insults and abouses and was told that the metter was alright and that I have to pay that bill and that Jan bill up that date had run 24 days $23 Acct. Now we were careful not to burn as much as previous month and *never did we use* your gess Such amont as you peopl clame.

We can not tell how you people make Such a great mistake. It had be come a joke and laughing stock your Gess bill against us. Now I paid $5.00 for Dec and 23 day in Jan. That amount is much more than any previous monce we ever had used gess. yet we have in your possession $2.50 in deposits. If you put your metter and try us if we use any such amont we Shall be willing to pay our bill. But we are positive that there must be Some mistak but cant tell how.

yours respectfully,

———

How to Sell Gas Appliances

EVERY gas manager has his own opinion as to how many ranges a salesman can place during a season. This opinion is based on what his own men have been able to accomplish. But the "Progressive Age", a New York publication, by offering cash prizes, secured definite figures, which show what can be done by expert solicitors. The competition covered a period of four months—from May 1st, 1909, to September 1st, 1909. It was made reliable by all possible safeguards in the way of rules and conditions, and was based on the following rating of appliances according to the gas-consuming size of each:

KIND OF APPLIANCE.	POINTS ALLOWED.	CONSUMPTION (CU. FT.)
Cooker	1	6,000
Single Oven Range	1.5	9,000
16-inch Double Oven Range	2	10,000
18-inch Double Oven Range	4	20,000
22-inch and Elevated Oven.	5	25,000
Cabinet or All-Gas Kitchen.	6	30,000
Extra Large Cabinet Ranges	10	50,000
Laundry Appliances	1	
Independent Water Heaters.	4	10,000
Automatic Water Heater, General Heating	6	30,000

The first prize, one hundred dollars, was awarded to Henry B. Richman of the Municipal Gas Company, Albany, N. Y., who made 3,510 points. Richman attributed his success to untiring effort and devotion to business; and to prompt calls, regardless of the hour, especially on those who had had their houses on fire, on those newly married and setting up households, on those who were building, on those living on streets about to be improved, on those moving, and on everybody else in the city who could be reached by a house-to-house canvass.

The second prize, seventy-five dollars, was won by J. A. Brown of the Rochester Railway and Light Company of Rochester, N. Y., who made 2,938 points. He believed in the house-to-house canvass and then in careful planning of separate campaigns. He would call at opportune times to meet the head of the house; he would decide on the outfits suitable for that particular kitchen, and would then try to install nothing less. He attended to complaints promptly—and personally whenever possible. His customers were often so friendly that he could exhibit to others the outfits set up in their private kitchens, rather than those in his salesroom. He allied himself with architects and builders, and with landlords, who, sometimes, could be persuaded to install rather than permit the damage from the changing of plumbing by the tenants. He worked hard, persevered, and adhered strictly to the truth.

The third award went to M. J. Goldbas of the Utica Gas and Electric Company of Utica, N. Y., for 2,841 points. He followed up the data on the record cards for his house-to-house canvass in a most scientific and minute manner. He advised against hurry in soliciting; ground covered should mean sales made. He believed in the judicious use of circulars. He warns salesmen to know their goods; a few months' work in the salesroom is a great benefit to the outside man, especially in the spring when the new stock is coming in. He has worked for his company nine years. In that time meters in use have increased from 3,500 to nearly 20,000, sales have been made of 12,000 gas ranges and 2,000 water heaters, 3,500 old houses have been piped for gas illumination, and 1,000 gas-arc lamps have been installed in business houses.

There were ten other prizes of twenty dollars each and five of ten dollars each. Many suggestions are embodied in the reports of the winners. In Norfolk, Virginia, a movement for new business was inaugurated by sending a force of men throughout the districts to clean flues, burners, and fixtures,

and thus get the people interested. Noticeable and frequently changed slides carrying advertisements were put on at the moving-picture shows. Large posters were placed on bill-boards calling the attention of the housewife to the fact that by having a gas range she could rest one hour longer in the morning and still have meals on time. Exhibit stoves were placed in different stores throughout the town wherever some one would take the name and address of any one interested. Every employee of the company was supposed to talk stoves, and many prospects were brought in by main and service crews and by the fitters. All stoves were sold, if the customer wished, at three dollars down and two dollars a month, and sales increased from thirty to eighty-eight per cent. over the same period of the preceding year.

In the other places listed,—Malden, St. Paul, El Paso, and all the rest,—the solicitors agree upon the following as the cardinal conditions of good sales reports:

1—A most careful system of house-to-house canvass.

2—Hard work, regardless of hours.

3—Truthfulness of representations.

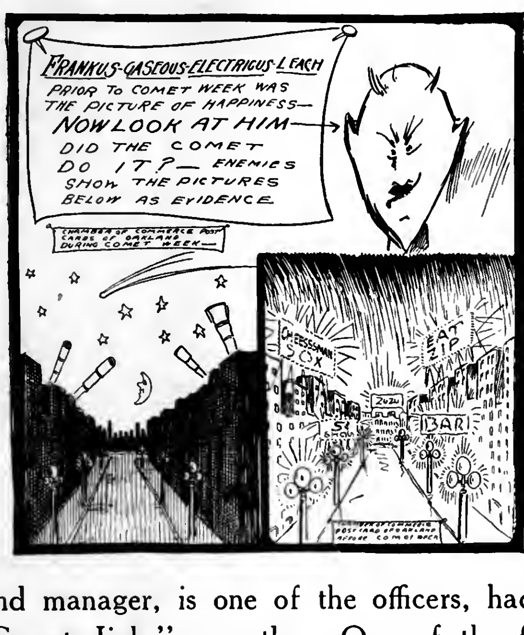
4—Knowledge of and confidence in the goods offered.

5—Good service after installation.

FRANK E. CRONISE,
Manager New-Business Department.

A Josh on the Oakland Manager

The Nile Club of Oakland, of which Frank A. Leach, Jr., the company's Oak-



land manager, is one of the officers, had a "Comet Jinks" recently. One of the features was a set of cartoons showing how the comet had affected some of the members. One night the city authorities ordered all street lights turned off so that the people could more plainly see the comet. This shutting off of the lights was made the theme of a josh shown in the accompanying small reproduction of a large cartoon.

Buying Land

In the April number of this magazine there appeared an editorial advising "buy land." This snapshot photograph was sent in by George C. Holberton, general manager of the San Francisco Gas and Electric Company, labeled "result of editorial 'buy land.' Hope others will do the same." In the group, which was busy one Sunday running some lines on newly purchased realty in San Mateo County, are (left to right) F. S. Gray, "Terry" Holberton, W. H. Kline,

general agent of the Pacific Gas and Electric Company; Larry Walsh, George C. Holberton (doing the painting), and "Bob" Garnett.

How to Handle Gas Complaints

By D. E. KEPPELMANN, Superintendent Meter Department, San Francisco.

D. E. Keppelmann

How would you answer a complaint? State the method of procedure from the time the complaint is received in the office until the order is finally completed. The foregoing question was submitted to each employee in the meter department at San Francisco. The writer has compiled their answers to form this article. Credit is due every employee who responded readily with many valuable ideas.

Many conditions enter into the handling of a complaint order, from the moment of its inception until its final completion. The two principal considerations are first, the consumer and, then, the company.

Let us assume that the complaint is one of "poor gas." Let us begin from the moment it is received. The counter clerk or the telephone operator should obtain the exact nature or location of the existing trouble. He should get the address, the name of the consumer, the kind of place, and the time the complaint was received. Also, he should specifically record whether the trouble was "no gas," which means no gas whatsoever, "insufficient gas," which means not enough for present requirements, or "poor gas," which means that the consumer has some gas and does not need immediate attention. The tag should then be issued by the recording department and forwarded promptly to the meter department. A duplicate tag should be kept on file. The tags are received by the meter department and segregated and divided into districts. The trouble man, when receiving his tags, carefully notes the information and proceeds to complete his work with respect to the importance of each complaint.

Let us assume that a complaint is received but not systematically handled. The following invariably is the result: No specific information is previously ascertained, and so the order is promiscuously sent out. The trouble man on his arrival spends a great deal of time hunting up the location and the nature of the trouble. The completion of the order is delayed, much to the annoyance of the consumer and at twice the cost to the company. Had this order been handled properly, full information would have been secured at the start, and the trouble would have been quickly remedied, much to the satisfaction of the consumer and at considerably less cost to the company.

Since a satisfied customer is one of the greatest assests of any company, and because costs play such an important part proper initial information should be carefully obtained.

Suppose the complaint clerk has received an order reporting "poor gas," and that he gets all information possible and immediately dispatches a properly equipped man.

It is assumed that this man knows that the main in the street and the service pipe into the house are both of sufficient size to insure proper pressure at all times at the head of the service pipe, if there be no stoppage in the service pipe and the house piping be of the proper size and the burners be in good condition.

First, determine the nature and location of the trouble. If it be general, that is, if it occur all over the house, the cause must be sought in the service pipe, in the meter, or in the riser. If it be confined to one floor or to one room, it is only necessary to examine the part of the system that supplies that floor or that room.

Poorness of light, due to a uniform low pressure with fluctuation, indicates the existence at some point of an obstruction formed

by solid matter. A quick jumping of the flame shows an accumulation of liquid at some point. A slow rise and fall of the size of the flame, taking place at comparatively long and irregular intervals, is a sign that the meter is overloaded or else that it sticks. Having lighted several burners in various parts of the house, the steadiness of the meter can be determined.

Examine the service pipe by removing the plug in the Tee at the head of the service pipe. If there be no plug, disconnect the meter at the inlet column; then observe the amount and force of the gas. If the service pipe be not clear, first insert a wire, and then use a force pump. If this effort do not remove the obstruction, pour in gasoline, followed by several blasts from the pump. When an accumulation of liquid is suspected, it can be readily detected by an intermittent flow of gas. Use the pump only, and the trouble will easily be remedied. Should the service pipe be all right, disconnect at the outlet column of the meter and note the passage of gas through it. If the service pipe be not free, the cause can easily be discovered. If the service pipe be free, then the trouble must be in the house-piping. Proceed to insert wire in the house riser; there trouble is often located. If this do not remove the trouble, the condition then must affect only a part of the house. Then notify the consumer to call in a plumber.

On the return of the order to the office the records department notes the trouble and refers it to the proper authority. If the trouble be a trapped service, it should be refered to the service foreman, who should replace the service pipe with a new one, or should give the proper drip to the main. If traps occur in the house-piping the consumer should be notified to call in a plumber and have the fault corrected.

The tags are returned to the records department. There they should be thoroughly checked by means of a history card-system or filing cabinet. This should be done for several reasons: to note the nature of the work performed, to check any repetition of orders at the same location and for the same cause, and to record the time consumed in the repairs and the quality of the work done.

For instance, an order reporting "poor gas" is sent out. The trouble man finds water in the service pipe due to a possible trap in the pipe. In many cases this same service pipe may have been pumped regularly once a week. The cost of this pumping might prove considerably more than the expense of having the old service repaired or replaced with a new pipe after the second or third call.

Thus the repair or replacement of service pipes may be attended to at once instead of six months later; may be accomplished after a few calls only, instead of after a possible dozen. And the result is satisfaction to the consumer and considerably less cost to the company.

From one of the editors of the Sacramento Bee:

The magazine contains a great deal of information that will be useful to us, and we will be glad to avail ourselves of it whenever the need arises.

A. J. Klung, who has been with the Mutual light company, a subsidiary concern of the San Francisco Gas and Electric Company, ever since it started fifteen years ago, first as office boy and latterly as bookkeeper and cashier, was quietly married at Palo Alto April 27th. His bride was Miss Elizabeth F. Duffey, and now they are at home to their friends Wednesdays in a pretty little flat at 1044 Cole Street, San Francisco. A few days after their wedding the groom's brother, O. J. Klung, became the proud father of a son. The similarity of the brothers' initials caused congratulations to be misdirected, and it was no joke.

"Any Old Kettle Will Make Steam"

By R. N. MILLER, Plant Inspector.

R. N. Miller

Everybody knows that. Where is the little boy who has not found it out for himself, while watching the kettle boiling on the stove and trying to stop the steam from coming out by thrusting sticks into the spout, only to get his fingers burnt for his pains? But will any old kettle make steam to the satisfaction of the engineer of a modern steam-plant or steamship? No; the engineer is looking for the most economical steam generator that the market can produce.

Let us briefly trace some of the evolutions of the kettle. Let us see what necessity and requirements have brought forth in the steam generator of today.

The earliest boilers were made of copper flasks with an opening at the top to which a pipe was attached for leading off the steam; such boilers were placed over an open fire. The steam generated by them was used by the ancients as early as 120 years before the Christian era to serve purposes of superstitious worship.

The first boiler to generate steam for any practical purpose was designed in 1655 by the Marquis of Worcester, who wished to generate steam to raise water for domestic and irrigating purposes and for driving water from mines. Because he considered the thing practical he was looked upon as a mad enthusiast. An extract from the description of his invention shows what he claimed and gives some idea of what he had to contend with: "Invention 68—An admirable, most forcible way to drive up water by fire; not drawing or sucking it upward, for that must be as the philosopher calleth it '*infra sphaeram activitatis*', which is but at such a distance, but this way has no bounder, if the vessels be strong enough; for I have taken a piece of whole cannon, whereof the end was burst, and filled it three quarters full, stopping and screwing up the broken end, as also the touch-hole, and making a constant fire under it; within twenty-four hours it burst and made a great crack; so that, having found a way to make my vessels so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water run like a constant fountain forty feet high. One vessel of water rarefied by fire driveth up forty of cold water: and a man that attends the work is but to turn two cocks, that, one vessel of water being consumed, another begins to force and refill with cold water, and so successively."

The boiler designed by the Marquis was placed below the level of the water to be raised. His vessels, being filled by gravity, their contents were raised simply by the elastic force of the steam. He stated a measure of steam: one pound of steam would raise forty pounds of cold water.

Following the Marquis came Captain Thomas Savary, who raised water by means of the vacuum caused by condensed steam.

All early boilers were either globular or spherical, and were set upon an open fire. But that arrangement required an enormous quantity of fuel to produce a small quantity of steam. The boiler was heated, and so also was every surrounding object more or less heated. The first steps to overcome this evil and its great expenditure of fuel were taken by Dr. Desaguliers, who encased the spherical boiler in brick work, a substance which he says was a "good non-conductor of heat and calculated to withstand the destructive action of the fire." He formed a furnace under the boiler with bars of iron to hold the fuel and a pit to receive the ashes. Round about the boiler he formed a flue leading to a

stack through which smoke and other products of combustion passed.

At that period the rating of power of boilers seems to have troubled engineers and manufacturers. A boiler horse-power was rated as six gallons of water an hour evaporated at a pressure of one atmosphere, or fifteen pounds upon each square inch. One pound of coal was capable of evaporating 6.14 pounds of water.

Boiler designs improved greatly from that time on, and patents were very numerous. The external appearance of the boiler was greatly changed. The ancient spherical was replaced by the cylindrical or rectangular tank or by combinations of both.

Newcom, Watt, and Bottom were the first to stay the flat surfaces of their wagon-shaped boilers. Smeaton in 1750 is credited with being the first to introduce an internal flue; Trevithic, the first to break up the water space by the introduction of tubes. Oliver Evans of Philadelphia was the first to introduce high-pressure, cylindrical, external-fired boilers, and he was also the inventor in 1786 of the first high-pressure engine. The history of Evans consists almost entirely of the romance of real life. Sanguine and energetic, he continually encountered difficulties and overcame them, and encountered renewed disaster and disappointment till at length he died of a broken heart.

Even at that early date engineers seem to have had their troubles. The Commission of the Franklin Institute of America was appointed to report on the structure, phenomena, and explosions of steam boilers. That commission consisted of Professor Walter R. Johnson, Benjamin Reeves, and Professor A. Dallas Bache. They framed the fundamental rules for boiler construction. Here is an extract: "Standard strength of boiler-plate 55,000 pounds, strength after riveting $\frac{2}{3}$, strength after heating and cooling in use $\frac{2}{3}$, strain of permanent extension $\frac{2}{5}$, greatest practical strength $= \frac{2}{3}$ of $(\frac{2}{3} - \frac{2}{5}) = \frac{1}{6}$ (nearly) of the actual cohesion, and the greatest practical strength to prevent explosion, being four times more than any boiler should be ordinarily worked at, we have 2/45 or 1/22 of the standard strength of the boiler iron, as its ordinary working pressure; 2,500 pounds of extension on each square inch of cohesion action may, therefore, be assigned as the safe working strain of iron boilers."

About this time the marine engineer first made his appearance. To him we are greatly indebted for the very great efficiency of the Scotch marine boiler as regards both performance and workmanship. At first ship-owners were so pleased at having their ships making regular trips between ports, independent of the elements, that the great space occupied by the engines, boilers, and coal was for a long time not considered. But, with the desire to increase the steamship's earning capacity, the boiler went through many changes, from rectangular wet-bottom to rectangular dry-bottom, from combinations of rectangular and cylindrical to cylindrical with the introduction of water-tubes and smoke-tubes. Witherhed, an American, was the first to introduce super-heated steam. But engine design had not progressed as rapidly as or even kept pace with boiler improvements, so super-heating had to be abandoned, as the steam raised to a high temperature was found to damage the valves and pistons of the engines and to burn the hemp packing.

It was not until 1859 that the Peninsular and Oriental steamship "Alhambra," plying between Southampton and Lisbon, was fitted up with Lamb and Summers super-heaters. The temperature of the steam as heated was only 360 degrees Farenheit, and the super-heater surface was four square feet the nominal horse-power. The report claimed a saving of 37 per cent. of the coal consumption with super-heaters, but this saving was due to the extension of the heating surface.

Engine design had all along retarted the development of the boiler. But with the introduction of the compound-engine pressures jumped from fifteen pounds the square inch to one hundred pounds the square inch. With the further development of the triple- and quadruple-expansion engine pressures have risen to two hundred and ten pounds the square inch and small boilers have been made to do the work of large ones. Forced drafts were introduced, first in a closed stokehold as introduced in the navy, then through closed ashpits as planned by James Howden, and lastly by induced draft in the stack as introduced by Ellis and Eaves.

In conclusion let us turn to the development of the water-tube boiler, which is now the boiler generally adopted for all purposes in generating steam. The Pacific Gas and Electric Company is so cosmopolitan in its ideas that it uses the following boilers: the Roberts, the Heine-type, the Babcock and Wilcox, the Stirling, and the Parker. The first water-tube boiler recorded was made by William Blakeley in 1766. But the first successful user of the water-tube boiler was James Ramsay, an American, who, in 1788, patented a water-tube boiler for use in steam navigation. Here may be mentioned some of the earlier inventors such as Wolf, Stevens, Griffith, Eve, Belleville, Wilcox, Clark, Moore. Special mention should be made of Julian Belleville as a most persistent and prolific inventor. He commenced work on the boiler question in 1850, and for a time was comparatively successful. But in 1900 his boiler was finally condemned for use in the British navy by a royal commission.

Sir Albert J. Durstan, engineer-in-chief of the British navy, is to be highly commended for the stubborn stand he made, in spite of the opposition he met from the engineers of all countries, when, in 1894, he installed the Belleville boilers in the British men-of-war "Terrible" and "Powerful." There were forty-eight boilers in each of these warships, with twin engines developing 25,000 indicated horsepower. The writer did considerable work on the "Terrible," in translating and redrawing from the French metric to the British standards.

The patent records show that every maritime nation is credited with a patent water-tube boiler. Even the Japanese, the most progressive nation, use their own patent water-tube boiler in their navy. The principal types are the inclined-tube, like the Babcock and Wilcox; the bent-tube, like the Stirling; the water-leg, like the Heine; and the latest, the down-flow-type, patented by J. C. Parker. The Parker boiler is comparatively new, and has been very much critisized both favorably and unfavorably by many eminent engineers. But the fact that it is gaining headway and becoming a factor in the market proves that it has merit.

I would refrain from expressing an opinion on any boiler in case of controversy, but suffice it to say that the best kettle is the one that will stand up to its work and require the least amount of expense in maintenance.

C. E. Sedgwick, a graduate of the University of California in 1893 and until recently connected with the company's commercial department, was appointed manager, effective June 1st, of the new Solano district, embracing the towns of Benicia, Cordelia, Suisun, Elmira, Dixon, Rio Vista, Davis, and Winters.

The Pacific Gas and Electric Company has been carrying about $2,000,000 of fire insurance and paying on it about $50,000 a year in premiums. This form of insurance is to be dropped as the company itself is to set aside regular contributions to a fire fund of its own while also investing some of the equivalent of that former premium money in equipping its properties with better fireproofing arrangements.

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ANOTHER GENERATION IN THE COMPANY

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PACIFIC GAS AND ELECTRIC MAGAZINE

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Spanning the Straits of Carquinez

By ARCHIE RICE, Publicity Manager.


Archie Rice

The Sunday editor admitted it would make a good feature story. Take a staff photographer, catch an early train, climb up into the skeleton tower, and snap some views that would show height and peril. Get a workman out on those cables, high above the waters of the strait, with a full-rigged ship down under him for a convincing background.

That was the plan on which the special writer was to work. Let the public know something about the meaning of that conspicuous structure nearing completion on the top of that bald hill near Benicia!

In the early morning the two newspaper men got their first look at the distant tower. Must be sixty or seventy feet high! As they steadily walked nearer they amended the first guess. Hundred feet! Hundred and fifty!

And then they came up under it. They bent backward trying to see the top. Some one informed them it was two hundred and twenty-four feet up there. A ladder extended all the way, clinging to the frame. It was like an open fire-escape reaching straight to the top of a fifteen-story building, without a break. Only there was no solid wall behind to keep you from seeing through and down as you climbed.

The photographer shook his head dubiously. The best pictures of the Yosemite were those taken from the floor of the valley! When you get up too high you dwarf objects down in the distance! You have no foreground from the brink of a precipice!

But they climbed to the top. There was to be the sensation and the scene! Rust from the night fog and the grime from dirty metal had made their hands like machinists'. Gee, but the view! And then the photographer looked down. He wanted to get down instantly. But he was afraid to descend by that terrible ladder. It was a fool idea, any way, making a picture story of a thing like this!

In the long ago that happened. But the same remarkable steel tower still stands sentinel there on the hill. The same massive steel cables span high across the Straits of Carquinez. And now, after nearly a decade, few even of the people of California, passing and repassing in transcontinental or local trains, in glancing up at that tower and noting the wires stretching high over their heads, know what it all means, what a marvelous engineering problem that construction solved.

The Golden Gate is a mile and a quarter wide, but it scarcely looks the part. Yet through that small passage ebbs and flows with changing tides a rush of waters that is almost inconceivably immense. There the

equivalent of a mighty lake gushes out while the tide is ebbing, is sucked back in again when the broad Pacific moves over and crowds its waters against the California coast.

The great interior valley of California, from the Siskiyous down to the Tehachepi, from the Sierras out to the Coast Range, an empire more than half a thousand miles long and nearly a hundred miles wide, drains all its creeks and rivers to a final common outlet, where the Sacramento and the San Joaquin join and pour their accumulated floods into the upper end of San Francisco Bay. And all that water, from a thousand miles of mountain-sides, has to go through the Straits of Carquinez, near the head of tide-water; has to escape by a passage less than two-thirds the width of the Golden Gate and not one-third so deep. When water is confined to a narrow channel there is more friction on the bottom.

The steep mountain rivers of the western side of the Sierra Nevadas made California a pioneer in hydro-electric development fifteen years ago, an increasing generator of subtle energy on a large scale. Developments soon showed that the current could be conveyed to a considerable distance from the place where the mountain water power generated it. Ambitious business schemes grew. The melting snows of the Sierras should be made to light the great cities down by the sea! The force of falling waters should be conveyed more than two hundred miles to do work reckoned in tens of thousands of horsepower!

Transmission was the chief problem: how to make short cuts across country and not risk failure in too long a line. The population was all on the opposite side of San Francisco Bay. To make a long detour by pole-line through the miles and miles of submerged lands and mazes of waterways in the delta district did not look practical. The Straits of Carquinez must be spanned! Telephone and telegraph cables had lain across the bottom of that channel for years, sheathed in protective cases.

Power Cables from South Tower (Contra Costa County) Across the Straits of Carquinez to North Tower (Solano County)

But how about putting big electric cables across, charged with sixty thousand volts?

How could they be regularly inspected for flaws and abrasions?

Carquinez must be spanned with aerial cables. Could it be done? Prior to 1901 the longest electric power span in the new world was for the West Kootenay Power and Light Company of Rossland, British Columbia. It swung high across the Columbia River with a stretch of 1,500 feet of cable. But the distance across at Carquinez was 2,745 feet down on the water-line, and the main span would have to be 4,421 feet in the clear between the final supporting towers!

Application was made to the United States government for permission to cross over that important stretch of navigable water. The federal officials consented, but stipulated that the lowest sag of the cables must be two hundred feet above the surface of the water at highest tide.

At that time the corporation bore the name of the Bay Counties Power Company. It was several years afterward that it became amalgamated with other companies and was called the California Gas and Electric Corporation. Then, early in 1906, further combinations were made, and the title was changed to the Pacific Gas and Electric Company of today. But at the time of the proposed cable crossing J. D. Galloway was the company's consulting engineer, and R. H. Sterling was superintendent of what was known as the Bay Counties division, which included the territory about the strait. These two men tackled the problem. Sterling devoted himself to the electrical features and to the creation of the peculiar saddles on which to rest the cables on the towers, and to the designing of the strain insulators. F. A. Koetitz, at that time chief engineer of the Pacific Construction Company, worked out the details of how the cables were to be hoisted up into place and their ends securely anchored.

After a careful survey of the topography it was decided to erect a high tower on the top of the hill at Dillon's Point, on the northern side of the strait, about half way between Benicia and the Mare Island Navy Yard. The hill there was one hundred and sixty-two feet above the water line. On the southern shore the hill was much higher, rising first abruptly, near the town of Eckley, and then rolling back and up to a height of about five hundred feet. Just how to get those cables strung across, how much to allow for sag, how high to erect the north tower and how far up the hill to place the south tower were matters for close figuring and careful calculations.

The engineers decided to make the north tower two hundred and twenty-four feet high. And in order to throw the lowest point of the sag toward the north shore and away from midchannel and the principal shipping traffic they figured they must have the top of the south tower at an elevation eighty feet higher than the top of the north tower. So they selected a point four hundred feet up the south-side hill and there erected a tower only sixty-four feet in height.

Now, they were to have four cables stretching across from tower to tower, hanging parallel in perpendicular rows. These cables were made of solid plow steel, with a solid steel core and nineteen wires in the surrounding twisted strand, making up a steel rope seven-eighths of an inch in diameter. Each of these cables had to be 6,400 feet, or nearly one and one-fourth mile, long, allowing for the sag and for the extension back of each tower to a secure anchorage.

The actual horizontal distance between the towers is 4,427 feet, but the downward curve of the heavy cables required a length of 4,482 feet for the span, or a sag of fifty-five feet from a straight line. The top cable was carried across with its sag 236 feet above the high-water mark, the second with its sag 226 feet, the third with its sag 216 feet, and the lowest with its sag 206 feet, or six feet higher than the government require-

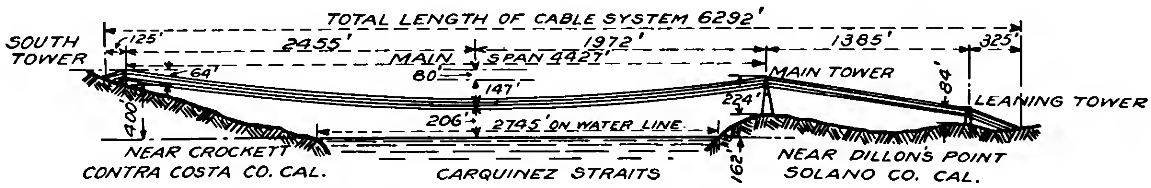
ment. The four ponderous reels of cables were slowly unwound as each was towed across from the south shore on a barge, and one by one they were hoisted up and strung into position, all within a period of five days.

The great weight of these remarkably long cables is one thing. But the engineers had also to figure allowances for the added strain imposed by winds blowing against that exposed surface on each cable, an area about 6,200 feet long and seven-eights of an inch wide. They calculated the wind strain at forty pounds to the square inch of exposed surface. The total wind strain would be 76,500 pounds, the line load 6,000 pounds, and the dead load 50,000 pounds, making a maximum strain of 132,500 pounds. The towers had to be strong enough to stand that and more. The anchorages had to hold that and more.

So the construction of the towers had been a subject for careful engineering skill.

On the hill above Dillon's Point bedrock comes close to the surface. That made it easier in securing firm foundations. A rectangular space was selected, and there were planted twelve concrete piers extending down into the solid bedrock and placed sixty-nine feet by eighty-nine feet between pier centres. These piers were made massive to serve as weighty anchorages to keep the towering superstructure firmly erect.

Back of this main tower, inland and down the slope, at a distance of 1,385 feet, was erected a leaning tower eighty-four feet high, tilted back at an angle of thirteen degrees toward the north, to help sustain the pull and support the cables on their way to anchorages three hundred and twenty-five feet further inland and down in the flat beyond a piece of marsh land. Each cable has its own anchorage of concrete nine by ten feet and five feet high, penetrating to bedrock and supplied with eyebolts with pin connections. The concrete piers under the leaning tower are set with thirty-one- by twenty-eight-foot centres.



Map of the Carquinez Cable Crossing

Across on the south side of the strait, where the main tower is but sixty-four feet high, and some distance from the shore line the cables slant more abruptly to their anchorages and without intermediate supports, as the distance is but one hundred and twenty-five feet. The foundations of the south tower measure sixteen by twenty feet on the pier centres.

Get all this roughly in your mind,—those hills, that width of water, the big cables, drooping high above the channel, straining with a pull of 24,000 pounds upon their anchorages, and then consider that electricity at an intensity of sixty thousand volts is ever thrilling silently through three of those cables.

Always one cable is held immune. Periodically the cables must be painted, covered with a protection against the elements. A man goes across there, high in the air, pulling himself slowly along in a tiny traveling cage, suspended on rollers using the cable as an overhead track. He crouches in his perilous-looking open swing and does his work and completes it. Then that cable takes the current, and another one is reserved for repairs or emergency's need.

On each tower each cable rests upon a large saddle having six insulators, and each one of these insulators weighs about fifty pounds. All the upper platform timbers

in the towers have been boiled in paraffine.

There must be no escape of the long-transmitted electric energy. It can not be permitted to leak away down the steel towers. No avenue of liberty is left for it to reach the earth. Back behind each tower the cables are "deadened" near the anchorages, and up near the saddles on the towers the regular power lines are spliced on to the big cables to form a continuous line of power transmission.

There is something peculiar about those great suspended cables. They actually move less on a windy day than on a perfectly calm day! Why?

Another thing the engineers had to figure out was the expansion and contraction that would occur in that long stretch of steel through variations in temperature. They found that the maximum variation in temperature there at the Straits of Carquinez is sixty degrees Farenheit. And that would mean a difference of five feet in the sag of each cable. But they got the bottom cable six feet higher than the government specifications any way.

In determining the height the lowest cable should be kept above extreme high water the government thought to make it higher than necessary. The ship Shenandoah, the largest of the American merchant marine, measures 214 feet from her keel to the peak of her highest mast and 194 feet from her water-line to her peak. That would give the Shenandoah twelve feet clear under the sag of the lowest cable at the highest tide, and anywhere from fifteen to twenty-five feet clear at other stages of the tide, or more than that if she avoided the sag. Yet, so deceptive are those cables as mariners approach from a distance that more than one captain has come up cautiously figuring on lowering his topmasts, and then seen with amazement that he had forty of fifty feet in the clear. In recent years a few new topmasts have gone up to heights that could not pass under the Carquinez cables. The ship Aloha stands 218 feet above her water-line, and there are two boats owned by the Standard Oil Company each with an upward reach of 212 feet.

So, now, you have something of the scope of that Carquinez cable crossing, and what it signifies in its function of getting mountain-generated electricity through from such distant points as the De Sable power plant in Butte County down those two hundred miles to Oakland, and even round the southern end of San Francisco Bay and up through the peninsular towns.

All the communities on the east side of the bay glitter at night and their cars and manufacturing industries thrill with the force that ever flows unseen through those cables that make the longest aerial span of any electrical transmission line in the world.

A Japanese Servant's Notes

They came just as they are here reproduced; laid on the dining table for the head of the house:

to Mr. Harold,

do n't read By Big Voice, you must watch about the Gertie, Because She Made two Cocoanut Cakes and She took to Her mother's House, More I will tell you, did you permitted to Gertie
She Call Her friends Cousins and relations of all She knows people and she Showing every Where in the House Just like action House, But I am Wish to Madam come Home.

From F. N.

To Mr. Alfred and Harold

do you excuse me, Because I was mistook about the Gertie's Cake, She was Made and Hidden Same Where, But I could not find the cakes Before But She brought From Some Where to day, So I was faster told you, I am so anxious about this, because you think Just to fool, But my mistook this excuse me and do not tell Her about this, so She angry to me, this is my secret.

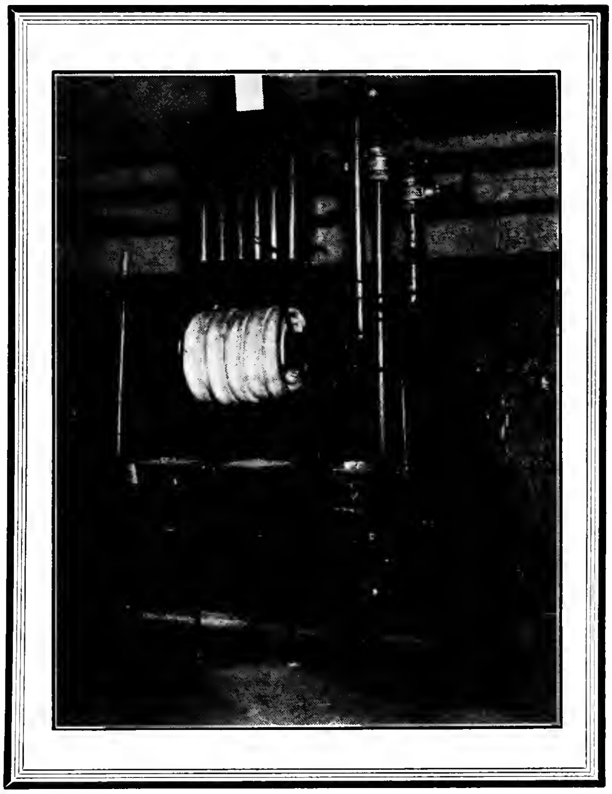
Model Fire Precautions at De Sabla

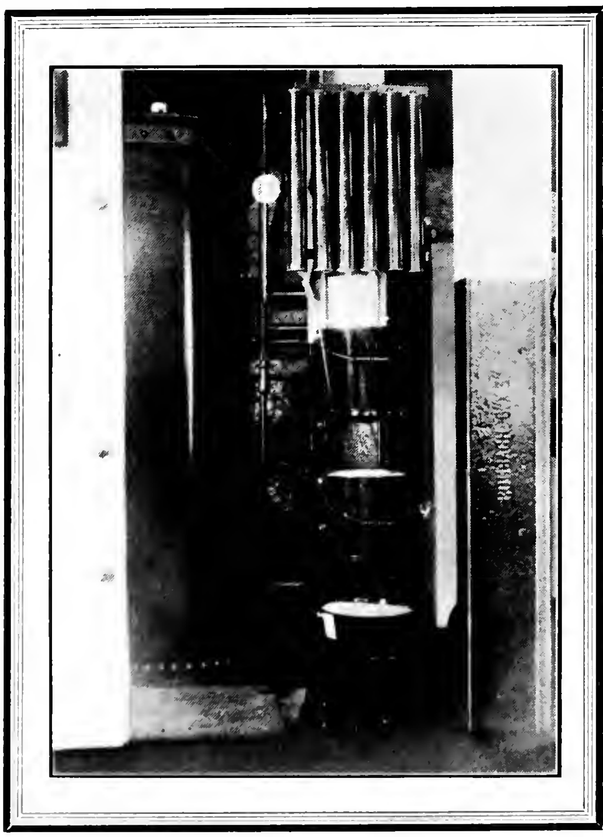
By R. J. CANTRELL, Property Agent.


R. J. Cantrell

How neatly and how workmanlike fire apparatus stations may be installed in power plants is well illustrated by what has been done in the De Sabla power house. The accompanying illustrations tell part of the story. The picture with three buckets arranged perpendicularly shows six powder extinguishers nicely hung on substantial hangers and below them three sand buckets arranged compactly on metal stands. The whole combination is attached to a steel column.

The picture with a clock above a switchboard shows the arrangement of two fire stations of six powder tubes each, one set on each side of the door to the telephone booth. Thus they are immediately adjacent to the switching apparatus at the main operator's stand, all in plain view and ready for instant use in case of fire.

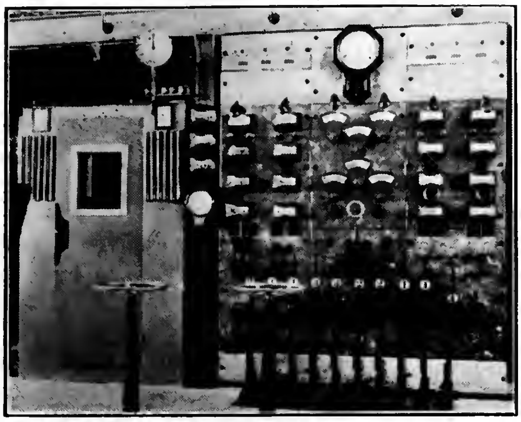




The other picture, conspicuous for its reel of hose, illustrates a station with six powder extinguishers, a reel with fifty feet of fire hose, connected and ready for use, and three sand buckets filled with clean, dry sand. All these things are arranged in a compact manner and are in an open space ready to be grabbed quickly and put to effective use.

This article is written complimentary to Superintendent D. M. Young and the foreman at the De Sabla power house, since the entire installation of the fire apparatus shown in the illustrations was left to their judgment. How well it was placed the pictures show.

The De Sabla power house has never been subjected to a fire of any considerable magnitude. But with this model arrangement of its fire-fighting equipment there comes



a feeling that if a fire should occur the men there are well prepared to extinguish it immediately and save valuable property to the company.

In addition to what the pictures show there have been recent additions of a chemical extinguisher to the equipment at the first station and at the station with the hose reel.

Oh Dear!

"Oh dear," said Mrs. Newlywed,
"My heart is nearly 'broke;'
My coal stove would not draw today;
I was stifled by the smoke.
From soot I was a perfect fright.
It made me feel quite blue.
My coal bills are so very high
I do n't know what to do."

"My dear," said Mrs. Upto-Date,
"Your story is not strange;
I suffered just as much as you
Till I bought a nice gas range;
And now no trouble troubles me,
No coal bills make me pine.
Joy reigns supreme in our home;
No ash, or soot, or smoke in mine."

ENVOI

If you would be content,
Have troubles by you pass,
Just buy a range that 's meant
Exclusively for gas.

Eugene A. Beauce.

Charles O. Barker, an employee at one of the electric substations in San Francisco, and Miss Lillian E. Mallen were married at Nevada City June 27th.

Two Fires That Teach

DURING the noon hour of June 21st a small fire occurred in the meter department at gas station B in Oakland. It was the result of the apparently careless use of gasoline by an employee of the meter department, and that employee was burned on both arms and legs.

A report covering this fire states that the employee was using gasoline to wash a piece of diaphragm leather; that he stepped on a match; and that the flash from the match ignited the open pan of gasoline and caused the fire and the man's injuries.

The lesson from this experience should bring home to employees of this company the dangers incident to the use of gasoline and make them more cautious in handling this dangerous liquid. Gasoline is dangerous at all times, and especial care should be exercised in its use.

In the Temescal substation, Oakland, the 10th of July, a fire occurred in one of the 100-light, air-cooled arc transformers. It was caused by a weakness in the insulation and it resulted in a fire in the coils of the transformer.

The operators, immediately upon discovering this fire, resorted to the use of three chemical fire extinguishers, which were at hand, properly charged, and ready for use. A survey of the damage done by this fire showed that a considerable saving had been effected by the prompt action in bringing fire apparatus to bear. Of the three coils in the transformer, one was considerably damaged, but the other two were saved and can be used again.

R. J. Cantrell,
Property Agent.

W. A. Widenmann is manager of the new Stanislaus District, with headquarters at Newman. His appointment followed the company's purchase and absorption of the Newman Light and Power Company.

Danger and Damage from Woodpeckers

THE red-headed woodpecker bores small holes in which to store acorns, and larger holes in which to make a nest.

The tip of his long slender tongue is like a bony spear-point, and with chisel beak and that powerful little tongue drill he bores nice, symmetrical little holes. Belonging to the bird family of climbers, like the parrot, with two toes forward and two backward, he clings on anywhere or upside down, and then hammers away for all he is worth.

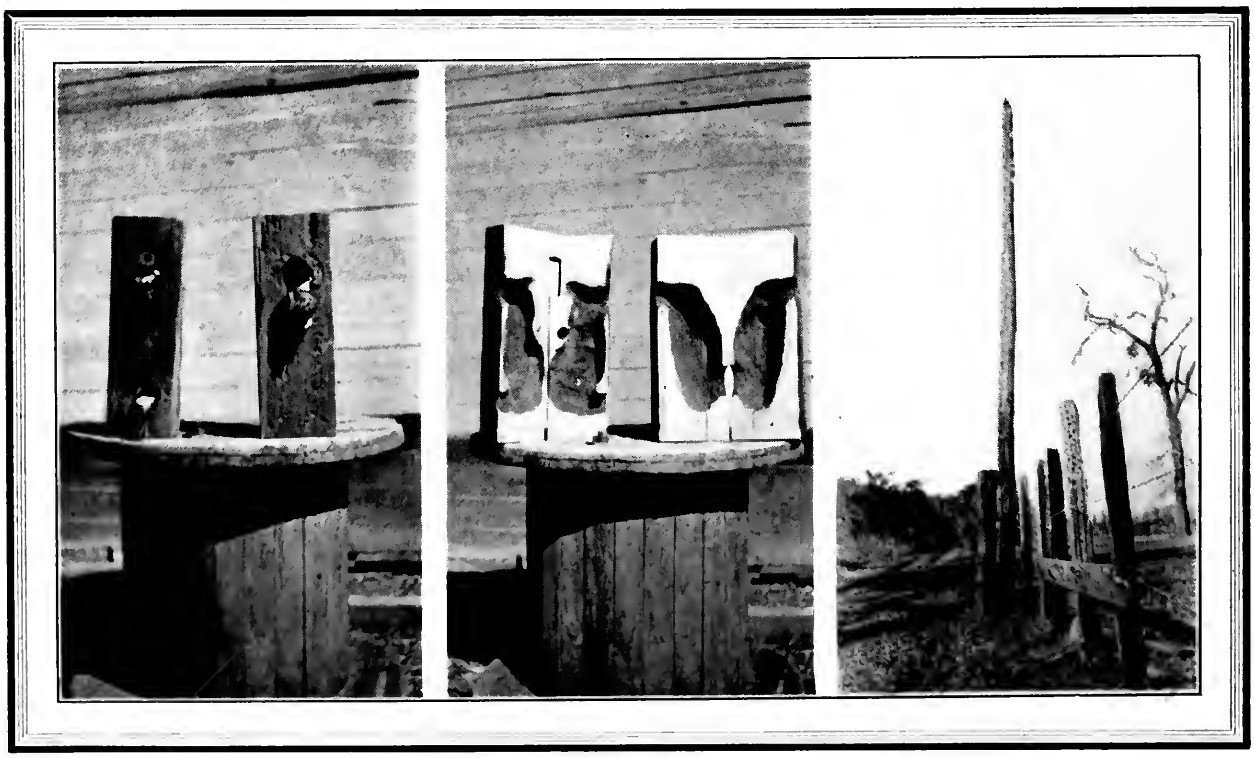
Dry wood is, of course, his favorite. The boring is easier and there is no sap to interfere. Telegraph, telephone, and electric poles were kindly put up for his convenience!

In the southwestern part of the United States, in California, and down into Mexico the woodpecker has so riddled railway telegraph poles that the condition is a problem. Preventative preparations have been tried on the outside. Steel poles have been suggested. But the little red-headed birds go cheerily on hammering away and drilling holes.

There is a double purpose in storing the acorns in dry wood. It keeps them safe for the season of scarcity, and they collect boreworms, which are considered added delicacies in woodpecker society.

The accompanying illustrations almost explain themselves. The first one shows woodpeckers at or in three nest holes in two short pieces sawed out of two square redwood poles that carried 60-kilovolt power lines of the Pacific Gas and Electric Company near Smartsville in Yuba County. The middle picture shows one of these blocks sawed open to expose the extent of the weakening effect caused by the woodpecker's borings for a nest. The third picture is a telephone pole in the Colgate power division, up in the Sierras, and shows a surface completely honeycombed for acorn storage, every square inch being perforated. The fence posts also show signs.

In the aggregate the woodpecker damage becomes an item of expense and concern to telegraph, telephone, and electric companies having pole lines with thousands of poles in country or mountain districts. A. R.



Red-headed Woodpecker Borings

The Problem of Preserving Poles

THE ordinary wooden telephone, telegraph, or electric-power pole lasts but eight or ten years, unless it has been originally treated with a preservative. In the wood itself originally are infinitely small things of the lower order of animal life or fungi of the vegetable kingdom. They subsist upon those parts of the dead woody fibre that constitute the strength of the timber. After they have munched away, what is left is akin to the consumed lungs of a consumptive after the bacilli of tuberculosis have preyed upon his lung tissue. The form of the wood is there, but what is left is worthless and brittle stuff. Then we are apt to say the wood is affected by "dry rot." It has simply been ruined by the animal life that has preyed upon its tissues. Many railroads deliberately burn their old wooden ties to destroy the rot-causing pests.

Last year it was reported authoratively that there were then 12,000,000 telephone poles in use in the United States. Remember that nearly all telephone poles are single trees of a certain size, one tree taken to make one pole. How many other millions of electric-power and electric-light and telegraph poles there are in the United States was not stated. But the grand total must be stupenduous, when you consider the great forests of young trees needed to supply them. And every year more and more poles are needed. Faster than certain civic centres order wires underground in comparatively small districts and eliminate sidewalk poles the spacious suburban and country districts are growing and demanding more poles.

At this rate the time is coming when the forests will not be able to supply enough poles. Experts say that that time is only ten years off.

If poles are to become scarcer then the price of poles will go up. And if the supply will not be sufficient for the demand then man will have to devise some means for lengthening the life of the poles now and hereafter in use.

Here is an interesting and a practical problem, how to preserve poles. There are three things to be considered. One is to prevent the destructive animal life. Another is to lessen the needless wear and tear on the outside of poles. And still another is, to decrease the number of poles by making companies combine wherever possible in the use of a common pole-line at shared expense instead of making a city's streets or the public highways bristle with limbless trees like some fire-swept forest. Where the government controls navigable waterways it does not permit numerous railroad bridges. The different railroads must combine on one bridge. Such was the rule promulgated in granting permission to the Southern Pacific to erect its great bridge at Dunbarton Point on the lower reaches of San Francisco Bay.

There are three methods of treating poles to kill the animal life within the wood. The best but most expensive method is to have a long tank; into it shove the pole, and then pump in steam till after four or six hours every pore is opened and expanded; then to withdraw the steam, cause a vacuum, leave open every pore; then force in a solution of creosote, which is a powerful antiseptic, and then to draw off the creosote and let the pole drip for a while. That pole is then germ-proof and ready for use. Another method is to dip the lower end of the pole into a hot solution of creosote and leave it for some time and then pull it out and immerse the end in a tank containing a cold solution, so that the pores may be suddenly closed and the creosote kept inside. This is a cheaper method. A third method, and one generally employed, is to use a brush on the

lower end of the pole, merely painting on the creosote. It is not so lasting in its results, but it is the cheapest way.

Creosote, zinc chloride, corrosive sublimate, and copper sulphate are all good preservatives for wood fibre, all antiseptics, that if driven into the pores of the pole will kill the animal and vegetable life that in time destroys the wood. All the little wood pests must have light and warmth and air, so they operate near to or at or just above the earth line. They do not work far below the ground level. So the rim near the groundline is the chief danger point to be guarded from their inroads.

Experience has shown that painting poles is no great protection. The most effective way is to treat with creosote at first. The thing is for some one to discover methods of treating with creosote by which poles can be preserved more cheaply than new ones can be provided.

Hundreds of poles are weakened and their lifetime shortened by the unnecessary jabbing of climbing spurs. Steps are put in the poles to help avoid this very thing. Yet many a lineman looks upon the steps as a kind of reproach to his skill, as though they were safety devices to be scorned by a real lineman!

How to save on cost and maintenance of poles is a matter that many an engineer may well consider with profit. The time is rapidly coming when poles will be a big problem. A. R.

Above the Power Plant

THE GREAT Electra power house on the Mokelumne River gets its water supply from the Blue Lakes and other sources some eighty miles away in the Sierra Nevadas.

In winter as well as in summer that water must not cease flowing. Men must guard its course and watch its source. A telephone line penetrates far into the mountain regions to keep the workmen in touch with the power plant.

Ever since the completion of the Blue Lakes system W. M. Bennett has had charge of those great water sources. He lives up there and, with a helper, patrols the waterways and guards the telephone line, particularly during the terrible mountain storms and cold of winter. And it can storm and be cold in the Sierras, as the unparalleled sufferings of the Donner party proved in California's early history.

The illustrations opposite well indicate a little of the aspect of things up in the Blue Lakes country in the dead of winter, and the Klondike life led by the men who are there ever on guard that homes and factories down in the sheltered distant valleys may constantly have electricity at the turn of a switch.

It is that very abundance of snow that insures an adequate water supply to carry the power plant through the dry season of a California summer. Nature seems to put a congealing check upon that flow in winter that she may have water to liberate when the fields are parched and man's need is greatest for the help that water gives.

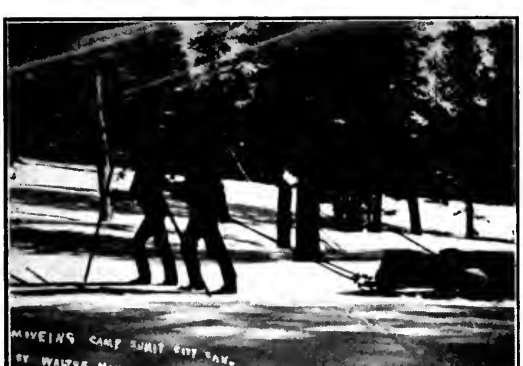
Snow is stored-up energy.

W. M. Bennett and his helper in winter quarters at Blue Lakes

The winter outlet from Blue Lakes

The boarding-house at Blue Lakes buried in winter

Camping on the snow while out repairing telephone lines



Bennett and helper moving camp, traveling on skis

Jeff Davis Peak, above Blue Lakes

MEN OF THE COMPANY

AUGUST FREDERICK HOCKENBEAMER

Office-boy, Stenographer, Railroad Official, Investment Expert, and now Comptroller, Treasurer, and Second Vice-President

"ON THE Banks of the Wabash!" Think of it. Here 's a man that was born and spent his boyhood living within two blocks of where the wonderful Wabash and the elusive Eel River flow together in the town of Logansport, Indiana. He has dived from the banks of the Wabash, and, even as a small boy, has splashed nearly all the water out of the swimming hole produced by these two famous streams that have been made big in song and story.

A. F. Hockenbeamer

Having become a resident of Logansport the 6th day of March, 1871, he is authority, as an early inhabitant, for the proud assertion that Logansport was once really a port. It was the head of navigation on the Wabash River just once, and for a few minutes. A little schooner got up that far in the long, long ago; and an ox team had to be prodded into the Wabash ankle deep to pull the stranded craft back down stream.

When A. F. Hockenbeamer arrived in Logansport he added one to a population of about 12,000. It was a town in a little valley, with three railroads and those two rivers running into it; and the railroads had their shops there, giving the place some payroll and position. Also hills, "mountains," rose about Logansport, to a height of nearly two hundred feet! Such were the boyhood surroundings of the subject of this sketch.

He waded and fished and swam in the Wabash, and grab-hooked suckers in the Wabash, and breathed with immunity the Indiana atmosphere that has produced that rare line of literary men for which the Hoosier state is famous. He attended the German Lutheran parochial school, then the public schools, then a business college; and so he came to the age of sixteen, without mishap or mission in life.

The 17th of August, 1887, when he was almost sixteen and a half, he began his career. Fresh from business college, able to

make fancy or shaded capitals or flying birds, familiar with double entry and ink-erasers, he got a job with the Pennsylvania Lines, right there in Logansport, in the office of the division engineer, a man named L. F. Loree; remember the name.

His title was messenger; his function, office-boy. He got up every morning at 4 o'clock and, after a hurried lamp-light breakfast, went down to business. All he had to do was to sweep out five big offices, empty the ashes from five big base-burner coal stoves, hustle coal from the first to the third floor to fill those five stoves, dust all the furniture, and fill and polish about forty nickel-plated student lamps every morning, all before the offices opened up for business at seven o'clock. Having done these few simple things, just to get his hand in as it were, he then began his regular day's work, and continued on till six o'clock at night, taking dictation, writing bills, keeping books, carrying out mail, running errands, delivering messages, and doing all the odds and ends that nobody else wanted to do. But he was paid well. If he had not kept well he could not have gone on doing just those few little things for the alluring salary of fifteen dollars a month!

In six months he was promoted to the position of stenographer. He continued in the service of the Pennsylvania Lines for fifteen years, at Logansport, at Wellsville, Ohio, and at Richmond, Indiana, advancing gradually to better positions and better pay, until he became chief clerk to the division superintendent at Richmond. He was then thirty-one.

The Baltimore and Ohio Railroad invited him to go to Baltimore, Maryland, and become assistant engineer of maintenance of way for its system of about 4,500 miles of railway. He went, and served a year. Then he was made assistant general superintendent of motive power of the road, and he occupied that position a year.

He next went to New York city as assistant to the president of the Rock Island-Frisco system of 14,000 miles of railroad. The president was L. F. Loree, who had been his chief seventeen years before. Loree had become the highest salaried railroad president in the United States. After one year as assistant to Loree in New York, Hockenbeamer resigned to become associated with the big banking concern of N. W. Halsey and Company. They made him their expert on railway investments and corporate properties submitted to them for financial consideration. He went forth and investigated and reported and recommended. He continued at this financial experting for Halsey and Company for five years, finally coming out to San Francisco in the fall of 1907 as their agent for several months at the time of the financing of the Pacific Gas and Electric Company under the unifying and refunding mortgage.

In February of 1908 he was made comptroller of the Pacific Gas and Electric Company, and in July of that year was given the additional title of treasurer, with its added duties. And this last February, two years after his entrance into the company, he was elected second vice-president.

He is now thirty-nine. Ten years ago, at Logansport, Indiana, "On the Banks of the Wabash," he married Miss Ethel F. Pryor. They make their home in Berkeley, and they have two children, boys.

He is a Mason, but he has no other affiliations except with amateur baseball as an umpire and with a large black cigar as a constant companion. A. R.

Eugene A. Beauce of the bookkeeping department was for several years on the reportorial staff of the San Francisco Call, doing the city hall detail, and he later held a political position in the board of education till the advent of McCarthy regime.

Napthalene Conditions in California

By SHERWOOD GROVER, Gas Engineering Department.

Sherwood Grover

It is not the intention in this article to deal with those special properties of napthalene which have been so often discussed. The peculiarities and particular attributes of this compound have been thoroughly presented and reported in the "Proceedings of Pacific Coast Gas Association" (Volume VI, pages 234 and 257). Both the chemist and the gas engineer have had their say.

Here is a quotation from a paper by E. C. Jones, entitled "The Effects of High Pressure Upon Illuminating Gas", printed in Volume I of the "Proceedings of American Gas Institute": "To enrich this compressed gas it is not necessary to scrub it with compression liquor. It is required only that the gas should pass over the surface of the liquor. The writer uses in connection with all high-pressure systems under his care a simple re-enriching tank through which all the compressed gas finally passes before going into the main pipe. This is called an auto-enricher, on account of its simplicity and self-operation." The quotation contains the key to the observations which follow.

The notes I have assembled on the subject of napthaline have been plotted graphically so that comparisons can be made in the easiest manner. These data were all obtained from three different gas distribution systems. The curves correspond to respective plants. The largest plant was that in System 1, the smallest that in System 3, and the respective daily output of the three was about as 10, 2, and 1. Each of the systems is a combination of high- and low-pressure distribution. All have three different kinds of service—low pressure direct, low pressure fed by district regulators from high-pressure mains, and direct high pressure with individual regulators. All of the systems have compression tanks of the same size for storage, although varying in number. But the methods of operating the different systems vary.

In System 1 there are several different high-pressure lines feeding as many localities distant from the works. Each of these high-pressure feeders has district governors feeding off into the low-pressure system at various intervals in its length. The pressure carried on this system during most of the year is twenty pounds, except for a period of two hours during the evening peak, when twenty-five pounds is maintained. During the winter months the peak pressure is carried five pounds higher than this. But one feature in System 1 which differs from the other two systems might be noticed. The compressors are shut down immediately before midnight. The compression tanks maintain the pressure as long as their capacity lasts. After that ordinary holder pres-

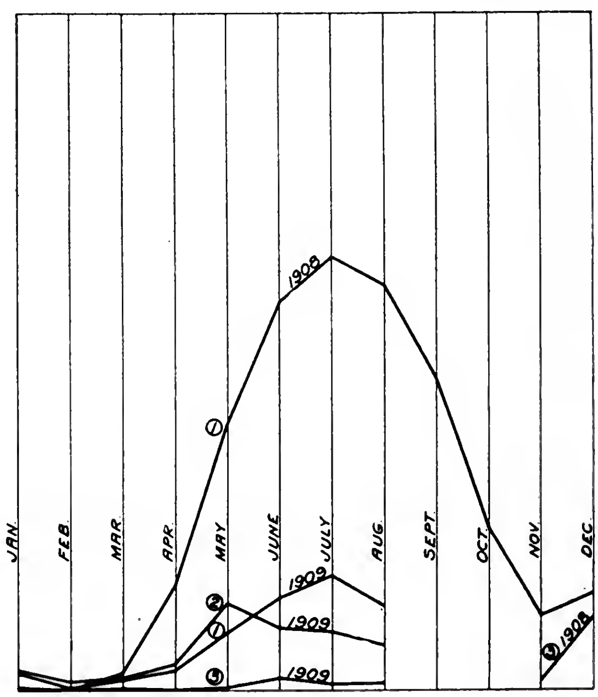


Plate No. 1

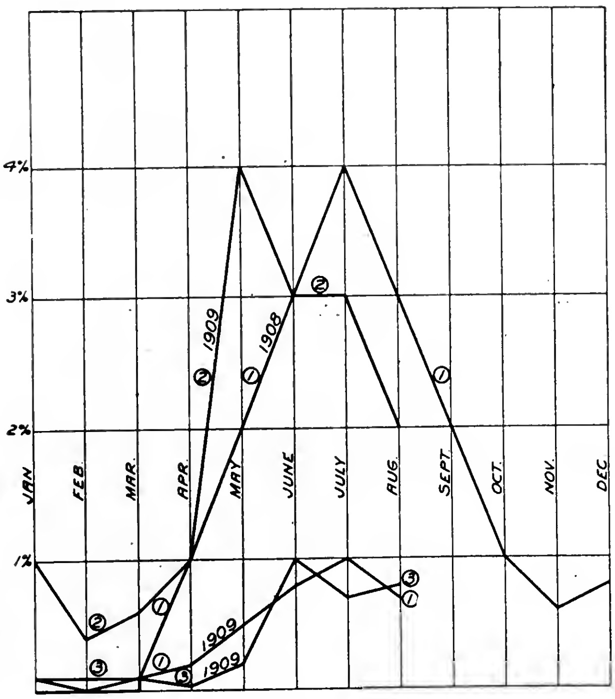


Plate No. 2

sure is maintained. In other words, for a period of approximately four hours its entire distribution system is under low pressure.

System No. 2 represents an inland city. In this case there is but one high-pressure line. It feeds a territory some distance from the works but having several regulators feeding off into the low-pressure system at intervals in between. In the operation of System 2 a pressure varying between eight and twenty pounds is maintained at different periods during the day, depending upon the peak load; and at night a constant pressure of two pounds is maintained on the high-pressure system.

In the case of System 3 there is an equivalent of two high-pressure lines starting from the works and feeding a distant territory, but on this main a pressure varying between twenty and thirty-five pounds is maintained. At no time during the twenty-four hours does the pressure fall below twenty pounds.

In System 1 all of the gas passes through one compression tank or autoenricher, there being no means of by-passing this tank.

In Systems 1 and 3 it is possible, by means of connections in places, to by-pass this tank and pump direct into the high-pressure main from the compressor.

In System 1 the records show that there were no napthalene complaints in the district supplied by high-pressure gas, either supplied direct by individual regulators or in low-pressure territory fed by district governors from high-pressure mains. This entire System 1 is all low-pressure for about four hours out of the twenty-four, or during the period of minimum consumption.

In System 2 they have no napthalene complaints in the district under low pressure that is supplied with high-pressure gas through district governors. Practically all complaints are in the direct low-pressure district. But they do have occasional complaints of napthalene in the district which is distinctly high pressure fed by individual regulators, and in these cases the complaint man usually reports the presence of a thick, dark, mostly black liquid. In fact, sometimes nothing is taken out but the dark liquid from which the napthalene crystalizes out on exposure to the air.

In System 3 the condition is somewhat similar to System 2, except that the stop-

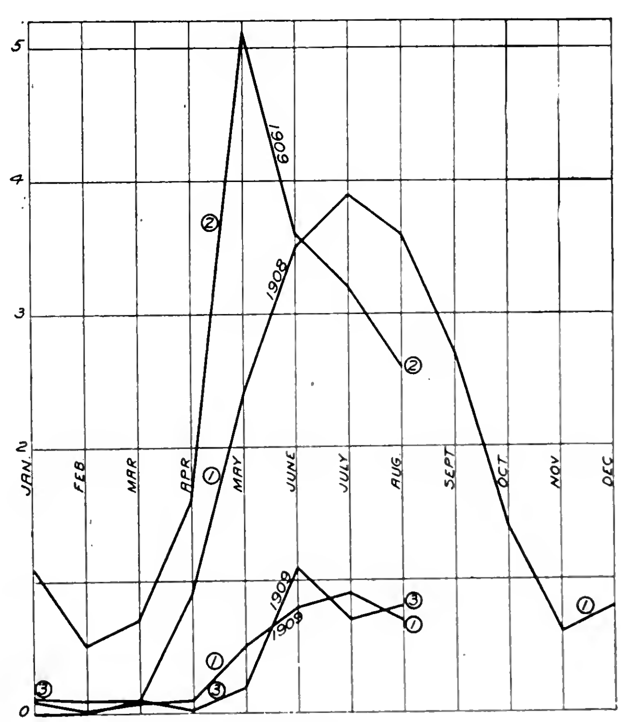


Plate No. 3

pages of napthalene in the distinctly high-pressure district is much more pronounced, and, in fact, has been so bad that it has plugged two-inch mains solid. The chief difference in the installation between System 1, where there are no napthalene stoppages in any district supplied by high-pressure gas, and Systems 2 and 3, where they do have napthalene stoppages in the distinctly high-pressure districts, is the fact that the latter two systems are equipped so that the compressors can pump into the main without passing through the autoenricher. In System 3 the compressors discharge into a ten-inch main, which is about fifty feet long, and reduces to a three-inch main. This length of pipe, when the compressors are pumping direct into the main, would act as a first-class trap for collecting benzol and the napthalene, which would be thrown down, the napthalene, of course, dissolving with readiness in the benzol. This condensation would accumulate at that point until the condition was right for the gas to force this liquid solution of napthalene out into the main itself. As this liquid travels along the main it is passing from a condition of higher pressure to lower pressure, and the ability of the gas under these conditions to re-enrich itself with benzol could have but one ultimate effect—the recrystalization of the napthalene from its solution with benzol.

In Plate No. 1 the actual number of napthalene complaints have been plotted according to a given unit of the three different systems for each month. This forms a means of comparison if you keep in mind the relative sizes of the plants mentioned, otherwise it means nothing except to show considerable improvements in System 1 between the years 1908 and 1909.

In Plate No. 2 the percentage of napthalene complaints in one month to total consumers affords a means of comparison on a fair basis, but will be of more practical value now that another year of the present method of keeping records has passed.

Plate No. 3 seems to be a fair method of making comparisons, although the nature of the curves is in a measure similar to those on Plate No. 2, a slight variation, however, being worthy of note.

From the Sacramento "Leader":

The January number of the Pacific Gas and Electric Magazine, published by the Pacific Gas and Electric Company * * * is devoted largely to Sacramento. A well-written article by Archie Rice describes Sacramento's street-car system. It is well illustrated, one of the halftones being a group of the veteran carmen of the system. In the group are Jack Elliott, William Craig, John Cleave, G. B. Redman, Otto D. Druge, William Dean, and Barney Harr. Another article, by E. C. Jones, chief engineer of the gas department, tells the history of gas lighting in Sacramento. It is also well illustrated, among the pictures being a handsome one of the state capitol and one of Sutter's Fort.

From the Sacramento "Bee":

The January issue of the Pacific Gas and Electric Magazine contains special articles on Sacramento descriptive of the gas, electric-lighting, and street-car systems, owned and controlled by the Pacific Gas and Electric Company. "Sacramento's Street-Car System," by Archie Rice, not only gives the history of this city's excellent street transportation system but it is illustrated by halftones. The pictures contain especial interest because of the fact that groups of old employees and the car-shop force are shown.

"The History of Gas Lighting in Sacramento" is another special article, written by E. C. Jones, chief engineer of the gas department. This article is also illustrated with cuts of the company's plant and a quarter-page cut of the workmen at the Sacramento gas works.

The magazine has a fund of information and is attractively made up. Sacramento, in the current issue, takes up the bulk of space.

B. D. Green of the electric contract department in San Francisco is the father of a little girl born the 24th of May.

When you can 't get to sleep it 's usually because you keep thinking or worrying. A simple remedy is to make a small sandwich of a slice of bread, sprinkle the insides liberally with red pepper. The pepper warms the stomach and draws blood there and away from the over-charged brain. There are no ill effects.

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EDITORIAL

Man's Capacity To Endure

Only those that have been through some great ordeal can know the power of resistance of which a human being is capable. Soft and fragile, when brought in violent contact with masses of metal or grosser materials, the body of man can be crushed, mangled, dissected, rendered lifeless in an instant.

But, in those experiences that do not quickly kill, man can endure torture, suffer thirst, go through long-continued periods of extreme cold, be without food or sleep for many days, and still survive. Nor is it man alone who is endowed with these latent possibilities clinching him to life in extreme cases. Women, children, even babies, have been known to live where the conditions of life had become the most discouraging and terrible. The history of the Donner party, with its pages of almost unbelievable, unimaginable privations and sufferings, where men, women, and infants survived through many weeks of pitiless cold, lost in deep snows in the high Sierras, eating old leather, subsisting on cow-hide soup made with snow-water, some even partaking of the carcasses of their dead companions,—that was a lesson, aside from its horrors, to make Californians down through succeeding generations realize that there is no suffering, no sorrow, no anguish which, in the severest tests, can prostrate those who have the courage to live.

That wonderful reserve energy displayed here and there through the world's record, shows that there is within the human body an extra special preservative power which a great need reveals.

The weaklings early become disheartened, give up, collapse. Those that persist are those that can resist. To such every hardship faced is an obstacle surmounted, an experience galvanizing body and mind to endure yet more, if need be.

The trouble with many men is that they do not wait to find out how much they can really stand.

Some suicide. Others irrigate. The suicide is a moral coward afraid to live when life looks hard. The man who drinks to forget his troubles is a mental weakling robbing his future of its reserve power of resistance. He fears to face the music; so he faces the bartender.

If all those men who, when things go wrong, give up and take gas or "bottoms up" and take booze could know the human capacity for suffering and surviving, what a great harvest of usefulness might be saved. If men who do only a little work because they have only themselves to sustain, could expend some of that latent effort which necessity and a large family draws from another man, how much kindlier might be the feeling among all classes of men. If those who lie abed late and idle away night hours could understand how much more they might be getting out of life—which is only so many or so few years, days, hours, minutes—how much more happiness and friendliness and effectiveness there would be in the world.

The greatest single physical affliction is to be blind, and yet blind people are ever cheerful!

Those that have not suffered bravely are those that complain the most. Idleness and inefficiency produce discontent. Busy usefulness is a cure for depression and despair.

Painless Surgery Under Electricity

EARLY in the present year a remarkable Russian woman arrived in New York from Paris. She is a doctor of medicine. Her specialty proved to be the resuscitation of animals believed to be dead from the effects of electric shock. She claimed to be able to restore a man actually "electrocuted," but none volunteered for the test.

Recently she has demonstrated some things in the application of the electric current to surgical operations that have made the great surgeons take notice.

Here is an extract from an article published in the Medical Record last May:—

Dr. Robinovitch electrocuted a rabbit by her own electrical equipment before the Hartford Medical Society, and after permitting one of the physicians present to listen for the extinct heart beats of the animal, again restored the heart and vital organs to their normal functions by reversing the current, the animal promptly getting up and running about the hall. On the following day she demonstrated for the first time in the annals of surgery, the uses of electricity for anæsthetic purposes on man.

The operation was performed by Dr. Marcus M. Johnson, assisted by Dr. Edward Herr, at the St. Francis hospital, upon a young Austrian patient, John C., 23 years old, who had entered a few days previously with his feet frozen. Gangrene ensued, and amputation was agreed upon on four toes, including the two great ones.

Dr. Robinovitch arranged her electrical device upon a long table in the operating room. From the storage batteries of an automobile stationed without, a wire was led through a window to the operating room and connected with a rheostat for governing the current, and two meters, one for voltage and the other for amperage. Finally, a small make and break switch was inserted in the circuit, and the equipment on the long table was complete.

The patient, now blindfolded, but otherwise unrestrained, was brought in on the operating table and placed in a position alongside and parallel to the long table.

[Then follows a technical description of the placing of the electrodes on the back, the front of the thigh, on the inner side of the ankle, and on the outer side of the leg above the ankle.]

Immediately upon the making of the current, anæsthesia of the limb below the electrodes was complete, and incision was promptly made. Apparently no pain was experienced by the patient. Following the amputation of the great toe of the right foot the electrodes were transferred to the left leg. Here the great, second, and third toes were amputated and flaps sutured over.

During the operation, which was of forty-five minutes duration, the patient laughed and conversed freely with Dr. Robinovitch and near-by surgeons, expressing himself as utterly unconscious of any sensation in the limb being operated upon, even when liberal incisions into the normal tissue were made for flaps and the bone was separated by the bone forceps. Two hours following the operation the patient was found sitting up in bed in an evidently cheerful frame of mind.

The advantages of this method of anæsthesia are obvious. Incision is allowable immediately on the closure of the circuit, thereby saving time for the operator. The frequent and oftentime serious after-affects of ether were totally absent, i. e., vomiting, gastric distress, and more remote complications of either pneumonia or nephritis were surmounted. In their places the patient showed little, if any, concern of having had an operation performed.

The type of current utilized by Dr. Robinovitch is the same as is used by her for purposes of resuscitation, whether it be coma from electrocution, opium, or other narcotics.

The current used is direct from storage batteries, capacity one hundred amperes each. The current is interrupted 6,000 to 7,000 times a minute, the period of passage of the current being one-tenth of the entire time. The current passes from the periphery centrally. The direct current was interrupted with Dr. Robinovitch's model of interrupter. The meters registered 54 volts and 4 milliamperes of current coursing through the patient's body locally. Electrodes used: Lumbar, 12x25 centimeters; roller electrode (on the thigh), 2x2; leg electrodes, each 4x8 centimeters.

"Can Butler Come Back?" He Did.

"TO THE man who has put all prognosticators in the field of athletics to thinking, the man that 'came back,' the noblest Roman of them all, J. 'Delivery' Butler!"

Such was the toast proposed by John A. Britton, presiding at the banquet following the annual baseball game played by teams composed of the heads of departments of the San Francisco Gas and Electric Company and the Pacific Gas and Electric Company Saturday afternoon, July 16th, at the St. Ignatius grounds, San Francisco. The San Francisco team was victor by a score of 17 to 13. This makes it one game for each team, with the tie to be played off next year.

In that toast was sounded the key note of the entire affair. True, the event of the day was the game itself, but the *motif* of the occasion, the real candy, was the coming back of J. D. Butler, captain and pitcher for the San Franciscos. And, take it from me, it is a matter of no small import for a man of past two score and ten, and a grandfather at that, to come back!

Several hundred spectators, including a large representation of the lovable sex, gathered to witness the game. And there was music, too! A brass band, made up of Dragovitch, leader, Melbourne, Murphy, Wentz, and Gewirtz, from the various departments, at intervals discoursed more or less melodious tunes.

John A. Britton, idol of all the employees, and umpire on strikes and balls, called the game at 2 o'clock. A. F. Hockenbeamer braved the wrath of the frenzied multitude as umpire on bases.

The first inning opened with "Gus" White of the "Get It," or gas contract department, at the bat for San Francisco. A. H. Caine was the gatling gun, and P. M. Downing the upholstered target for the Pacifics. "Gus" took first on balls, and stole

Henley, Keppleman, Britton (umpire), Lisberger, Cantrell (returning to third), and Varney—at the moment the umpire called Bridges out because Downing interfered with the ball

second and third. "Johnnie" Cunningham also walked. "Charlie" Barrett struck a foul and, thinking it was a hit, sprinted to first, and upon his return struck out, thus experiencing two disappointments in one day!

Frank Varney hit the ball, but he did not generate sufficient energy to convey him to first, although he did bring White home. Then Frank Oldis stepped forward with grim determination and secured a "Closed" tag by striking out, leaving Cunningham "Locked" at third.

When Henley of the Pacifics faced Butler there were whispered queries, "Can Butler come back?" A hush of expectancy followed as the doubting Thomases said confidently: "Nothing to it. He 's in Jeffries's class." Henley went to first on Oldis's fumble, and to third on Cantrell's hit, but was caught "Intermediate" between third and home and "Shut Off." Cantrell scored on Downing's hit, and Walton faded away. Bridges knocked a grounder that glided contemptuously past Oldis and Barrett and let Downing come home. Lisberger struck out.

As Butler, proud of having held the Pacifics down to two runs, walked in majestically from the box, a sweet creature from the addressograph department remarked in an audible whisper to her escort, a dashing bookkeeper: "Look, dear, Mr. Butler is coming back." He was.

In the second, Harry Bostwick, genial custodian of the outer portals of the president's office, hit to first. Then it was that the interest became tense to the bursting point, for Butler, the mighty Butler, faced Caine, his rival for pitching honors.

"Will he do it?" was again heard on all sides. And he did. He hit the ball for three fouls, and then struck out. Gurnett hit to first, and when Keppleman stepped to the plate he was presented with a tin basket of vegetables in which a huge head of cabbage predominated. "Kepp" became so rattled at the tribute and the cheers that he could n't "Unlock" himself, and struck out. White's two-bagger brought Bostwick and Gurnett home, while Cunningham did the same for White, and Barrett's hit enabled Cunningham to score. Varney was put out at first. Bridges, Lisberger, and Wilson made three runs in the third inning, in which Barrett muffed Cantrell's fly but had the satisfaction of seeing him tagged at the home plate. Butler distinguished himself by holding Walton's fly.

In the fourth Keppleman annexed first and went to third on White's long fly, his second two-bagger of the game. Holberton and Barrett struck out, and Varney popped a high fly that brought "Kepp" home. Oldis's hit sent White home, Bostwick took first on balls, and Oldis and Varney filled the bases. Butler again faced Caine, but at this critical juncture he was not able to raise Caine. Butler struck out.

Then Cantrell, Walton, and Downing filled the bases for the Pacifics. Bridges's hit went by White, who successfully protested against Downing's interference. Bridges was declared out as was also Lisberger later on, while Wilson's hit brought Cantrell home, and Downing was put out at second. "What 's the score?" shouted one excited fan.

"They 've sent for an adding machine and Roy's green-ink crew," yelled McCarthy, the blonde bookkeeper. And the band struck up "Every little bit added to what you 've got makes just a little bit more."

In the fifth White's hit helped Gurnett to score, and George Stroh, who batted for Barrett, did not generate sufficient candlepower to light his way to first, although Keppleman got home by the glimmer. Varney struck out, Cunningham failed to reach first, and White and Bostwick were left on bases. In this inning "Larry" Walsh substituted at left field, and Assemblyman McManus did the same at second. "Mc" was a sight to behold. Resplendent in gorgeous

bloomers of a composite lavender-crimson-purple hue, he was greeted with cries of "Oh you $10,000 beauty!", "Pull up your trousers," and such like.

Vensano succeeded in getting home, and Henley's long drive sent Caine and himself home, while Gurnett was sitting on the ball out in left field and wondering why he could not find it. Cantrell and Walton flickered and went out, and Downing made it four for

Umpire Britton, Catcher Downing, Barrett at bat, Joe Butler's grandson on extreme right

Pacific on a wild throw by Keppleman to third. Then it looked blue for Butler.

"They 're going to get your goat," came from some fan.

"Do n't you believe it 'But.' They 've got it already," cried "Jerry" McCarthy, who specializes on collections. But Butler came back again, and Bridges made it three outs.

In the sixth Keppleman brought Gurnett and Butler home. Walsh, who has taken on flesh since he assumed the arduous duties as assistant to the San Francisco company's general manager, went to bat, with Keppleman and White on bases. He threw out his chest, the fielders moved nearer the fences, and then Walsh struck out. White was touched at second while off the bag.

In Pacific's half, Bridges and Lisberger, like the Prodigal Son, came home on a passed ball, and Henley also scored.

In the seventh with a score of 11 to 13 in favor of the Pacifics. Butler whispered instructions to his men, and they responded nobly to the tune of six runs. Stroh got one of them; and three runs, mark you, were made by Varney, McManus, and Bostwick on Butler's, J. "Delivery" Butler's, hit. Butler did a war dance at second, and came home and into his own on Keppleman's two-bagger. Then "Kepp" scored on a passed ball. In the last half of the seventh Butler caught a pop fly, Bridges went out, Downing was caught at the home plate by Keppleman, and the San Francisco-Pacific game passed into history.

This is the way it looked to Harry White, official scorer, after the smoke of battle had cleared away:—

PACIFIC GAS AND ELECTRIC COMPANY

	AB.	R.	BH.	PO.	A.	E.
Henley, 1b.	5	2	2	4	0	1
Cantrell, rf., lf.	5	2	3	0	0	0
Walton, lf., rf.	4	0	0	0	0	0
Downing, c.	2	2	2	14	1	0
Bridges, 3b.	3	1	0	0	0	0
Lisberger, 3b.	4	2	0	2	2	1
Wilson, ss.	5	2	2	0	2	2
Vensano, cf.	2	1	0	0	0	1
Cain, p.	3	1	2	1	1	0
Totals	33	13	11	21	6	5

SAN FRANCISCO GAS AND ELECTRIC COMPANY

	AB.	R.	BH.	PO.	A.	E.
White, 1b.	3	3	3	9	1	0
Cunningham, rf., 2b., lf.	3	1	1	0	0	0
Holberton, rf.	1	0	0	0	0	0
Walsh, rf.	2	0	0	0	0	0
Barrett, cf., rf.	3	0	0	0	0	1
Stroh, cf.	2	1	1	0	0	0
Varney, 3b.	5	1	2	1	1	0
Oldis, 2b.	3	0	1	1	1	1
McManus, 2b.	1	1	1	1	1	1
Bostwick, ss.	3	2	1	1	3	2
Butler, p.	4	2	1	1	4	1
Gurnett, lf.	3	3	1	0	0	1
Keppleman, c.	4	3	2	6	1	1
Totals	37	17	14	*20	12	8

RUNS BY INNINGS

	1	2	3	4	5	6	7	Tls.
San Francisco	1	4	0	2	2	2	6	17
Pacific	2	0	3	1	4	3	0	13

*Bridges out for interference.

SUMMARY

Home run—Henley; two-base hits—White (2), Caine, Cantrell, Keppleman; first base on balls—off Caine 6, off Butler 4; struck out—by Caine 14, by Butler 2; hit by pitcher—Keppleman, White; stolen bases—Cantrell, Downing (2), White, Cunningham (2), Oldis; umpires—John A. Britton and A. F. Hockenbeamer; scorer—Harry R. White.

The Banquet

In the evening about thirty officials of the two companies sat down to an elaborate menu at Tait's. The arrangements had been well made by George C. Holberton. After the material things had been discussed, John A. Britton started a "Feast of Reason and a Flow of Soul" that proved highly interesting and lasted until a new day was peeping.

J. D. Butler, in responding to the toast drunk to him, said that he was going to petition the legislature to change his middle name from "Dennis" to "Delivery." The toastmaster then made one of his characteristic speeches, in which he likened the game of life to that of baseball. Some were fortunate enough to reach home, either through their own efforts or by the "assists" of helpers, while others failed to reach the first goal through "errors" or other setbacks. He called on P. M. Downing to tell how his team lost the game. Downing replied that the unexpected had happened; J. D. Butler had "come back." But there was hope for the Pacific team next year, for Butler, like Roosevelt, would not come back the third time.

D. E. Keppleman, head of the gas meter department, told what he did not know about baseball and urged "team work" by the employees in the interest of the companies.

Toastmaster Britton hailed C. L. Barrett as "one of the also rans," the "Nestor of Nestorines" in the gas company, and the "Bearded Giant of Sausalito," and wanted to know what excuse he had for playing ball at his time of life. Spectacled "Charlie" Barrett said: "I have no excuse. But I have found out that the glass-armed and glass-legged men are not in it with the glass-eyed men. I think that victory was due to Butlerism and other things we are compelled to undergo."

A. F. Hockenbeamer, who was introduced as "my associate in crime," stated that he was forced into acting as second umpire, because he did not know the first thing about baseball. "Admitted," interjected Britton, and Hockenbeamer sat down.

George Stroh figuratively patted himself on the back for landing on the sphere, but objected to being dubbed "Big Indian Chief Who Could n't See Ball."

R. J. Cantrell was asked to explain why he missed the ball so many times. "I do n't see how a man can be so fond of Misses," said Britton. Cantrell smilingly attributed his poor form to the eating of too many cucumbers.

E. B. Henley stated that his home run pleased his wife more than it did himself. It was a family affair anyway, a home run.

F. H. Varney was asked to tell how the San Francisco company won the game. He replied that while the Pacific outfit had the better team, Butler had outgeneraled a superior force.

David Augustus White, commonly known as "Farmer," was, so the toastmaster explained in introducing him, regarded as a good politician by ball players and a good ball player by politicians. White invited everybody to become a member of the Gaselco Social Club, which will give a barbecue September 5th, near Mountain View. He notified them all to "stick around" that day. Then he beamed with joy when Holberton announced that the San Francisco company would contribute financially to make the barbecue a success.

Then John McManus described a dream he had in which he was refused admittance to the heavenly regions because he told St. Peter that he knew he was a politician, while "Gus" White was allowed to go in because he only thought he was a politician.

D. H. Foote said the reason the Pacifics lost was because stars like himself and W. H. Kline and A. C. McDavid were kept on the bench. And the over-corpulent McDavid interrupted with the explanation that he would have played but it was abso-

lutely impossible to reduce seventy pounds in four days. Kline further remarked that had Downing used ordinary judgment in selecting his team the Pacifics would have won.

George Holberton urged hearty coöperation of all present in popularizing the company with the public.

Others who spoke were L. H. Newbert, Frank Oldis, John Cunningham, H. A. Bostwick, A. H. Caine, S. V. Walton, S. J. Lisberger, L. F. Walsh, Harry R. White, C. J. Wilson, M. H. Bridges, George L. Tulloch, Eugene Beauce, and A. J. Gurnett.

EUGENE A. BEAUCE,
Bookkeeping Department.

A Jolly Vacation

ONE evening in June a trio from the San Francisco company's office, "Gus" White, he of the flowing locks and stentorian voice, J. J. McManus, well known in California's legislative halls, and George N. Stroth, whose mission in life is the pacifying of ungrateful consumers, boarded the overland train bound for Lake Tahoe.

[Sketched by Stroh]

They left their business cares behind for a period of two weeks. They likewise left behind them a score or more of expectant friends who had all been promised messes of toothsome lake trout. Therefore, after arriving at the lake, they were eager to begin operations. Buoyed up with hope, and with visions of fish as long as their arms, as prophesied by the many-hued postals and summer-resort advertisements, they sallied forth.

It was, alas, the same old story. After several fruitless attempts, they took an old fisherman's advice and engaged an Indian to row them to the haunts of "Brer" Trout. The results exceeded all expectations, and as fish can not be bought at the lake, the recipients of various fine messes can rest assured that "the bunch" actually caught them. What with fishing, riding, and mountain climbing the two allotted weeks glided swiftly away. With sunburned faces and hands they returned to the city, thankful for the opportunity afforded them to enjoy one of the beauty spots of California, if not of the world.

G. N. S.

Lee H. Newbert, manager at Redwood, had a halftone picture of himself and a personal write-up in the Sacramento Bee of May 12th, under the title "Men of Superior California Who Have Made Good." The article mentions that he was born in Smartsville, and it traces his progress up to his present position in business and fraternal orders.

To Prevent Smoky Cities and Fireplaces

SOME of the principal places in Europe and about a score of the cities of the United States and Canada have a municipal ordinance against smoke from factory chimneys.

Smoke is a nuisance to be abated. The atmosphere over a thickly populated community must not be unnecessarily laden with these discoloring, unhealthful, and soiling fumes.

Of course, Pittsburgh has no restrictions as to smoke. The city reeks with it; a sooty pall hangs over the community, and the linen and clothing of the inhabitants are flecked with the constantly floating little black particles. St. Louis and some other cities derive their principal local wealth from manufactories that burn large quantities of soft coal; so smoke is tolerated.

In Massachusetts the state law specifies: "Dark smoke or dense gray smoke shall not be allowed to escape from any building or premises except locomotive engines, plants furnishing power for public-service corporations, or plants burning wood exclusively, for more than six minutes in any one hour of the day or night."

Investigation has shown that the absolute elimination of all smoke is practically impossible where soft coal is used.

Some cities have a smoke inspector. He goes about provided with the Ringlemann colored charts or screens. He places these charts in a row and then, stepping back to a distance of about fifty feet from them, he looks at them and then at the smoke issuing from a nearby chimney, studying the color and density of the smoke until he determines just which screen effect it represents. The screens are numbered from black and dense to lighter and thinner smoke. There is a cash penalty for each class. A fine of ten dollars or as much as fifty dollars, according to the density of the smoke, is imposed for the first offense; and this fine is doubled for succeeding violations.

The whole trouble seems to be in the design of furnace used. Properly constructed furnaces and flues will insure more complete combustion, prevent smoke, and really make the consumer save coal that is needlessly sent up the chimney in unburned sooty particles.

Even with private residences the smoke nuisance often exists indoors, because of the builder's ignorance of the very simple rules for the construction of a fireplace chimney. When smoke comes back into a room from a fireplace it is the fault of the chimney. No properly constructed fireplace will smoke. The rule for fireplace and chimney construction is this: Say you are to make your flue, up through the length of the chimney, 8 x 8 inches, or 64 square inches, for the opening. Then the fireplace opening must be practically 640 square inches, or ten times the square area of the flue opening. In this case the fireplace could measure only about 26 x 24 inches. Now the throat, that narrow slit between the fireplace and the flue, must always be a little smaller than the square area of the flue. In this case the throat could be the full 26 inches across and about $2\frac{1}{3}$ inches wide. If the chimney be made much higher than the ridge of the house there is danger of producing too much draught and causing too quick combustion and letting heat go up and be wasted. A trough-like pocket should be provided at the bottom of the chimney flue to deflect and return any chance downrush of wind, which would otherwise come directly through the throat and send a gust of smoke back into the room.

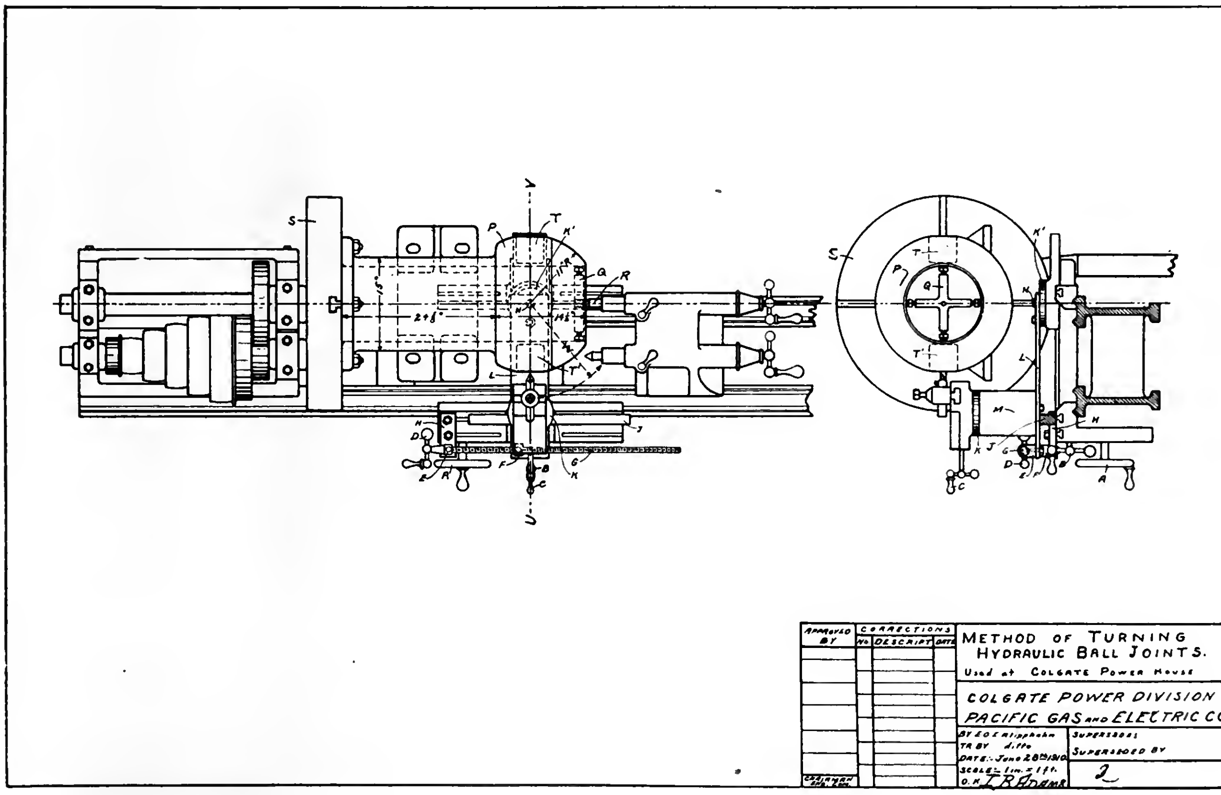
A. R.

Vegetable stains may be removed from the hands by rubbing them with a slice of raw potato.

Turning Hydraulic Ball Joints

UP AT the great Colgate power house in Yuba County the machinist, C. H. Becker, has devised and is using unique methods in the production of important parts of machinery.

The accompanying sketch is one he has submitted to illustrate the method employed in the production of hydraulic ball joints. Superintendent I. B. Adams reports that the scheme is a good one and has been quite successful at Colgate.



In describing the drawing Becker writes:

"P shows the ball to be turned; it is held in the lathe by the face plate S, and the centre R is held by the aid of the spider Q. In order to make the centre of the swing come under the centre of the ball a steel plate L was used, which was fastened to the cross slide K and made to swing on the pin N. In order to move the tool around the ball we use the screw G, which engages the nut F, which is fastened to the end of plate L, and is made to swivel. E is a bearing to hold G in place; it also has a swivel bearing. H is an iron block bolted to the carriage to hold the bearing E.

"To make the radius between the points N and W the tool is fed by the hand wheel C on the compound rest. M is an extension of the tool post, which, on ordinary work, is fastened to the cross slide K. J is a steel bar to build up between the carriage and the cross slide K. B is the cross-slide feed. A is the hand control carriage feed.

C. R. Gill, superintendent of electric distribution at Sacramento, became the father of a baby girl, born Sunday the seventeenth of July. A few weeks before that Will T. Gehan, a clerk in Gill's department, was also presented with a baby daughter; and not long before that J. Z. Strauch of the meter department under Gill, celebrated the arrival of a boy in his family.

The Company's Celestial Mediums

By CHARLES L. BARRETT, Secretary San Francisco Gas and Electric Company.

Charles L. Barrett

The title of this article suggests something spooky, but it is not intended that way. The subject is so material that its consideration has been given much attention by such a prosy end of the company's business as the gas and electric contracting office.

Ever since gas or electricity has been furnished to any of its consumers the San Francisco Gas and Electric Company and its predecessors have had upon their lists large numbers of the Chinese population.

Because these very excellent people are not always able to speak our language sufficiently well to make their desires understood it has been found necessary for the company to employ as an interpreting medium, both for its own and the consumers' benefit, some intelligent Chinamen. For a number of years the company's Chinese agents had no particular office in Chinatown. They made their daily departures from and returns to the main office. But during the strenuous competition with the Equitable Gas Light Company, from about 1900 to 1903, closer contact with the Chinatown business seemed necessary. So an office was established in what was considered to be the centre of Chinese business activity, the west side of Dupont Street, near Jackson, upon the street floor of the old Globe Hotel, which at one time, in the early fifties, had been San Francisco's most fashionable hostelry. The building had been remodeled for Chinese occupancy. This office was so brilliantly lighted at night with gas and electricity, both inside and out, that about ten o'clock it startled one to touch the plate-glass windows because of their sizzling hot condition.

The Chinatown office was an excellent advertisement. Because of that oasis of light the street in front of it at night became a regular congregating point for large num-

The Chinatown Branch Office from the Outside

Interior View at 752 Sacramento Street

bers of Chinese unemployed, loiterers, and street talkers.

About March, 1906, that original office was supplanted by one of the company's regular branch offices. The new office included in its district boundaries not only all of Chinatown but the entire North Beach district. It was located at the gore formed by Stockton Street and Montgomery Avenue, and it extended through from one street to the other. Its work was more largely with the Chinese than with the other inhabitants of the district, as the Chinese were in the majority as consumers.

The wide-spreading fire of April, 1906, included in its devastating sweep that excellent little effort of the company to get nearer to its consumers. That office was never reconstructed.

After the fire the company retained in its employ its old Chinatown representative, Sam Lock, who, although he had no regularly organized office, made it known to his countrymen that his residence and phone were always available for the company's business. Of late the company has been more particularly represented in the Chinese quarter than in the recent past. One of its Chinese employees, Hing S. Lee, a Chinese native son and merchant, has offered the use of his store and clerical force for the company's benefit in the taking of applications for gas and electricity from prospective customers and for the payment of bills by Chinese consumers.

The pictures herewith show the exterior and interior views of the store. It is located at 752 Sacramento Street, and is operated under the firm name of Kwong Sang Wo and Company, which, like most of the Chinese firm names, is only a fanciful title having no reference whatever to the names of the individuals forming the partnership. This one means: "Worldwide in character, vigilant and active in business, independent yet peaceable." In the interior view the good-natured, portly man with the light-colored coat is Hing S. Lee. He is one of our progressive, up-to-date Chinese young men, having discarded the queue, and affili-

ated with our people and institutions as far as innate instincts and traditions will allow.

The Chinese have always been large users of artificial light. They do their work and keep their stores open until late at night and sleep up to a late hour in the morning. They are also excellent pay, their financial education requiring that all obligations be honestly discharged at farthest by their New Year's Day.

In order to effect proper notification of bill amounts when the Chinese consumer is not found at home by the company's collector notice forms printed in Chinese characters are left on the premises. A reproduction of one of these notices is shown herewith. It reads, commencing at the top of the right-hand column and reading to the bottom, repeating this procedure with each column, working toward the left, as follows:

"Our company having been established a number of years and having expended a great deal of money in San Francisco, it should be patronized by the Chinese people, and this patronage will be much appreciated. We now have a special office in Chinatown at 752 Sacramento Street. This notice is to suggest that you pay the accompanying bill there to Lee Hing Sue or Lee Yuk Sue, the company's agents at that address, if you do not care to go to the main office—445 Sutter Street."

本公司開創數十餘年歷蒙華友光顧銘感五內現
爲華友利便起見如本公司收銀西人到來收銀時
適有事外出不遇請將此原單卽携到唐人街七百
五十二號廣生和內交代理華人
李崇瑚
李崇登 簽收便可電話差拿八百五十七號
或交總公司在所打街四百四十五號
舊煤氣電燈公司謹識

What They Say

From the Van Arsdale-Harris Lumber Company, San Francisco:

May number received and contents partly perused, and will say that I am very much pleased, and thank you for putting me on the mailing list, as I find many things of interest in the magazine, which are short, spicy, and very comprehensive. (Signed) Matt Harris.

From an editorial in the "Progressive Age" of New York, issue of May 16th:

The Pacific Gas and Electric Company of San Francisco has a photographic room and outfit of its own. Here drawings are reproduced quickly and accurately, and the saving in time and labor is found to more than pay for the expense of one man to operate the apparatus. Beside the copying camera the work will no doubt be extended to the new-business department, contract department, and claims department. A photograph is a useful form of record and can be utilized in so many ways that a dark room is as necessary to a well run company as a gas-testing room or a chemical laboratory.

From P. C. Wickersham, Oakland:

Many thanks for the check and the honor of being a prize-winner in the magazine contest. Wishing your interesting and instructive magazine much success.

Three Classes of Corporation Employees

In Which Class Are You?

IN EVERY large concern, like the Pacific Gas and Electric Company with its 3,500 people, there are three classes of employees. In one class are those who, having no interest in the company and no desire for its progress or success, enter upon their work distastefully, with a lack of interest that manifests itself in ways that are apparent to the officials of the company and which usually cause dismissal at the earliest convenient moment. Such employees are often disloyal to the company in their conversation with their companions. They may charge the company with extortion, injustice, over-reaching, and the like, while they themselves are the poor, abused, unappreciated, underpaid slaves of the concern, only longing for the hour when their desserts will be recognized and some more honorable employer may be found to enjoy their services. Such employees are usually prone to appear at their posts at the last moment in the morning and as surely to disappear promptly in the evening. During business hours they do in a half-hearted way only what they can not avoid, often throwing upon others who are willing some work which they themselves are quite able to do. Such employees are not only of no value to the company but they are positively a damage. They should not wonder that others are found to fill their places or that there is never any advancement for them.

Another class are those employees who, while they would not malign the company or steal its time, are most punctilious in their hours of arrival and departure, strictly honorable in performing to the dot the round of duty allotted to them, and give the company credit for being honest in its dealings; yet the thought seems never to enter their minds of doing more than mere duty or of taking any action outside of office or factory that might be to the advantage of the company. Such men give "an honest day's labor for an honest day's pay", as they put it; but they are of little profit to the company. They would very strongly combat the idea that the company got more from them than it paid for. They give a dollar's worth for a dollar. Companies, like individuals, employ men for the profit there is in their employment. If men barely earn the wages paid, while they are in one sense no hindrance to the operation of the company, they are a handicap in another sense, for they are holding places that might be filled by men who would be of value to the company above the daily wage which all agree they earn.

This brings us to the third class of employees; those who are building up their future, not only by doing their daily duty honestly and consistently but by making the company's interests their interests, in office, at home, and abroad. Such men are loyal to the company and speak in its interest whenever opportunity offers. They try to secure for it a new customer when the way is open. They defend the company's honor when it is unjustly attacked. They do not begrudge a few minutes at the beginning or the end of the day, when they see that the interests of the company require a little extra time. They keep alert always that they may learn something that might be of benefit to the company. Employees of this stamp are profitable. They may not discharge their daily duties any more exactly than those of the second class, yet they are constantly laying up credit for themselves by doing just a little more than duty demands, and so each dollar in wage paid to such employees earns for the company other dollars. It is from this third class that the men for higher positions are taken. From the

ranks of the first and second classes men seldom rise. They go on to old age, often wondering why advancement never comes. In view of these conditions it seems somewhat strange that employees are content to be found in either the first or the second class. But such is the blindness of the majority of employees to their own best interests. This partly suggests why it is that so few are qualified to rise to the more important and lucrative positions in any great business, while thousands may be found to carry on the routine of office or shop.

[EDITORIAL NOTE.—Submitted through the office of the secretary of the San Francisco company by an employee who wished simply to be "Anonymous."]

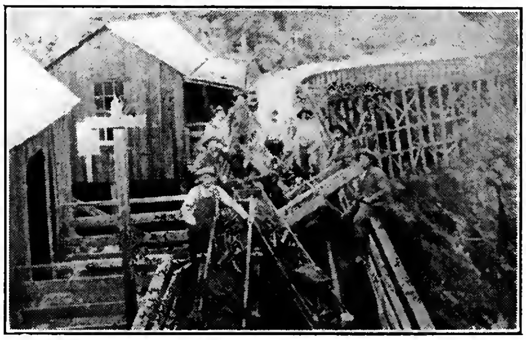
Caught at Colgate

A fifteen-pound fish measuring thirty-six inches in length was caught in the Yuba River at the Colgate power plant by the two employees shown in the picture. On the

left (hatless) is B. H. Wilcoxon, accountant; and on the right, E. G. Wilcoxon, an operator. They report a lively time landing their gamey prize.

An Indian's Contribution

This is the flume crew of the Colgate power division. The picture was taken at the Happy Point. The boys are returning to the Chute Camp, which is a building right on the flume, way up river. This



In from repairing the great flume

Left to right—C. H. Jones, extraman; A. E. Gilbert, second foreman; J. W. Gibson, flume-tender; John Strond, extraman; T. Cavanaugh, flume-tender; F. W. Halvey, flume-tender; C. L. Royat, flume foreman; H. E. Potts, flume-tender.

flume clings along the mountain side for eight miles, high above the Yuba River. The boys have finished raising the flume just above the penstock. Flume work is busy work. The water must not stop. The power plant must run. Mr. C. L. Royat has charge of the flume work. He is the second man on the right.

HUBERT E. POTTS,
Flume-tender, Colgate.

[EDITORIAL NOTE.—Hubert E. Potts is a husky young Californian Indian, and this is his first effort at a magazine article. His educational opportunities have been quite limited, but his associates at Colgate say of him that he is one of the most efficient workmen in that division.]

The city of Alameda has a municipal electric light plant, but in July it advertised for bids for electric current to be supplied by some commercial company during daylight hours. The hope was to cut down expenses by running the municipal plant only for the general night demand, and then it could be made to pay.

Machine Tool-Drive

THE direct-current motor of two hundred and twenty volts has proven the most satisfactory installation where a wide range of speed is required for machine tool-drive for lathes, for boring mills of the vertical and the horizontal type, for drill-presses, shapers, and so forth. But for planers, slotters, punch and shears, rolls, fans, centrifugal pumps, line shafting, and similar apparatus the alternating-current motor of two hundred and twenty or four hundred and forty volts has been found the most efficient.

The alternating-current motor, when used in planing mills or where dust is present, has the field to itself, as it causes no commutator troubles. Dust and other foreign matter have proven very destructive to the direct-current machine. Where a direct-current motor of the shunt- and compound-wound type is used much care must be taken to protect the shunt field circuits, because an open in such circuits will always prove disastrous to the motor as well as to the tool. This is so because an excess of speed is attained when the shunt field circuit is opened.

Direct-connected shunt- and compound-wound motors of the variable speed type are the most valuable for machine drive, and such motors should be used for metals, castings, and forgings. In the old methods of cone drive considerable loss of time was caused by the shifting of belts, the changing of gearing.

The most desirable and perfect motor for lathes, boring mills, drill-presses, bolt-cutters, and so on is the shunt-wound type with an interpole. The windings on such a motor are in series with the armature and are sparkless under every condition, and they have the rocker arm stationary. With this motor the widest ranges of speed are obtainable, and perfect commutation is secured. These motors are of the same horsepower rating as the common type of shunt- and compound-wound, but they are considerably larger on account of the low speed attainable and also on account of the small interpole and the additional size of the armature. This feature has too often been the cause of the use of the common type of shunt- and compound-wound motors. Since space is invariably a feature of machine tool design, shapers should be driven by compound motors of variable speed types, as the reversal of the cutting tool increases the torque. The compound winding assists materially in holding the inrush of current within reasonable limits. And that is a material consideration.

Compound-wound motors should be used on all machines of the reciprocating type, such as planers, slotters, shapers, and so on. But I have found that motors of the interpole type gave very good satisfaction on slotters, and that the common shunt-wound type proved itself fairly well on planers.

The main feature of the reciprocating drive is the self-regulation of the motor. It is most noticeable in the shunt- and compound-wound type, or in the induction motor, as the speed varies slightly in these motors, from no load to full load. With motors for planers allowance should be figured for the short travel of the planer bed on short cuts, as considerable current is required for the reversal. The horsepower required for this type of machine should be determined only on the inrush of current on quick reversals, rather than on the power the cutting tool requires. Heavy flywheels will, to a certain extent, remedy this evil when used on punch and shears, presses, and other machines requiring flywheel acceleration; but great care should be observed in starting because of the heavy inrush of current during the period of acceleration.

Motors of 1,500 or more revolutions a minute, of the direct-current type, will always cause commutation troubles if direct-connected to fans, blowers, and so forth, as the high speed causes considerable vibration. But this trouble can be partly eliminated by the use of belts.

Series motors are mostly used only for cranes, hoists, transverse and turntables; the speed, of course, varying with the loads. They will stand an almost unlimited amount of hard usage. But the series motors or any motor requiring the use of armature resistence for regulating duty proved by actual use to be disastrous to machine tool-drive.

All starting and regulating apparatus for machine tool-drive should be located or controlled from a point very handy to the operator, and, when possible, should be located on the carriage of the machine.

Any silent chain drive makes a machine more simplified, as it eliminates the network of gears. It is also valuable where the driving gear is located some distance away, but this would require intermediate or idler gears and additional shafting and bearings.

Rawhide gearing is an important factor in machine tool-drive; it eliminates noise. But my advice is to get your rawhide gearing much larger than the steel-cut or brass gears for the same work.

The maintenance of motors is a very important item in machine tool-drive. In my own experience I found it very trying in the beginning, with one hundred and sixty-five motors ranging in size from one-fourth horsepower to two hundred and twenty-five horsepower, to teach machinists to be electricians. Motor manufacturers should make small apparatus so that no part would be accessible except to persons allowed to clean or repair the electrical apparatus.

The cost of maintaining an alternating-current motor of the induction type is small as compared with the cost of maintaining a commutating motor. So the alternating-current drive is far better adapted for planing mills, private machine shops, laundries, and such industrial concerns.

In the course of my experience I have assembled data on more than one hundred individual machine tool-drives, showing the size of the machine and the horsepower used. But that is another story.

PAUL R. SHIPLEY,
Foreman Bonding Car, Sacramento.

Joseph Mayo, with the creation of the company's new Contra Costa District, was made district manager the 2d of July. His headquarters will continue to be at Martinez, since the Pacific Gas and Electric Company has absorbed the properties of the Contra Costa Electric Light and Power Company. The new district embraces the towns of Antioch, Pacheco, Concord, Walnut Creek, Franklin, Port Costa, Crockett, Valona, and the territory intervening.

The electrical industry has grown bigger and faster than almost any other industry in the United States. The federal census bureau showed that three years ago there were more than six billions of dollars invested and more than thirty thousand electric plants for commercial purposes, not counting exclusive and isolated plants.

After all these years the city of Tarsus, in Asia Minor, famous as the birthplace of the Apostle Paul, is waking up to modern conditions. It now has four hundred and fifty electric street lights, and some six hundred incandescent lights in houses. The power is generated by water from the Cydnus River.

A. G. Stayart, an operator at electrical station I in San Francisco, is the father of a daughter born March 7th.

A Good-Natured Watt-Meter

By JOSEPH P. BALOUN, Head of Draughting Department.

Joseph P. Baloun

Before enlarging on the hospitable nature of this particular meter I should like to call your attention to the series of non-technical though fully descriptive articles that will appear monthly in this magazine in the form of simple "Electric Talks." These short explanations will be not only for the benefit of the various departments of this company that are not so closely connected with the engineering end of the profession, but also for the consumer that pays the bills and who wishes to learn how he can understand and reduce them intelligently.

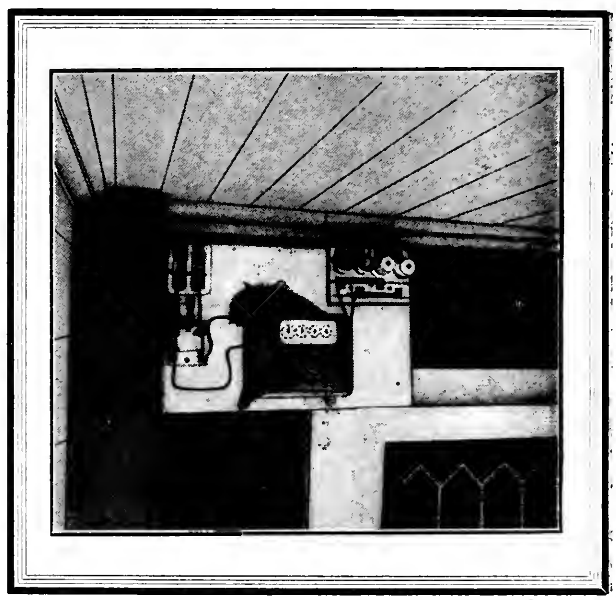
It is seldom that an electric company's meter is given any such mild description as the title of this article seems to indicate.

Despite the important fact that every user of electricity ought as thoroughly to understand the use of, the workings, and the alleged failings of this much-abused instrument of measurement, as he believes he does the butcher's or grocer's scales, he simply looks with surprise at each month's charge against him as represented by the electric company's bill. So the only definition that the majority of the consumers can give for their house meter is that "it registers the bill."

It is not the purpose of this short article to explain how a meter registers the consumer's bill.

This summer a mother bird of the wren family determined upon locating her nest for the coming brood of feathered children on the writer's porch. She first felt fascinated with a large branch of miseltoe suspended from the ceiling, and commenced house construction immediately without any written specification. But this was soon checked, for the nature of the support of the future home was not such as to warrant safety for the coming family. So the stork was promptly notified of the over-anxious mother's attempts at such a hazard, and through some authority the location was changed to the top of the iron case of the innocent though ever-industrious alternating-current watt-meter, as shown in the illustration.

Although Mr. and Mrs. Wren are evidently as innocent of the interior of the sombre-colored meter case as many of their human neighbors, they no doubt enjoy the lullaby or humming noise that is given forth



by the working of a piece of alternating-current mechanism and use this monochord for the fascination of their present little brood of four. Thus, beside taking advantage of the unsolicited hospitality of the company's apparatus away from Tom and Maria Cat's curiosity, they disclaim any race suicide in their domain.

The writer has with great pleasure witnessed the repeated acts of both Mr. and Mrs. Wren in their painstaking efforts at attempting to satisfy the unlimited appetites of their four ever opened-mouthed youngsters—Jimmie, Billie, Bobbie, and Johnnie Wren.

May God bless all human families that do as well by themselves and for their own.

QUESTION BOX

Ask questions. Any one of the several thousand men and women in the Pacific Gas and Electric Company who wishes information pertaining to any phase of the company's work or concerning matters of common interest to residents of any section reached by the company's lines, is urged to use this department freely. Send your questions to the magazine. There will be no charge.

Query:—What is the approximate wattage loss on an electric meter not in use?

G. N. S.

Answer:—The watt losses in electric meters vary according to the size. For instance, a 3-ampere, 110-volt meter has a loss of 4.84 watts, while a 2,500-ampere, 550-volt meter has 26.1 watts' loss.

A. J. T.

Query:—Is the stairway at the Great Western Power Company's plant at Big Bend on the Feather River, extending from the power house up to the top of the penstock, the longest wooden stairway in the world?

I. CLUMITT.

Answer:—Do not know, but it is so claimed there. It has 478 steps, and those who make the climb all agree that it certainly holds the record for distance.

I. DIDTOO.

Query:—Is the dam just above the Electra power house the second highest earth dam in the world? If so, what dam surpasses it in height?

A. DAMSITE.

Answer:—The Tabeaud dam, above the Electra power house, in Amador County, was, when constructed in 1900, the second highest earth dam in the world. It is 123 feet high, and was surpassed only by an earth dam at San Leandro in Alameda County 125 feet high. But since 1900 several earth dams have been built in both America and Europe exceeding 125 feet in height, and more recently earth dams have been constructed in Mexico for the Necaxa power plant, a hundred miles to the southeastward of the City of Mexico, that are fifty or sixty feet higher than either the Electra or the San Leandro dams.

JAMES H. WISE.

Query:—(1) Does a time-limit relay break a greater current than an ordinary trip-coil? (2) When a time-limit relay is employed will the current at the time of the release of the switch (fifteen seconds after the lines blow together) be greater than at the moment the short occurs?

H. O. A. BARTL, Hammonton.

Answer:—A time-limit relay does not necessarily break a greater current than an ordinary trip-coil. A time-limit relay is designed to be used in connection with a trip-coil to delay the action of the latter, that is, to allow a pre-determined interval of time to elapse between the time of short-circuit, or over-load, and the action of the switch or other circuit-breaking device operated by the trip-coil. In practice the current will generally be less fifteen seconds after a short than at the instant it occurs, for the reason that the voltage, due to increased current, will be considerably lower after fifteen seconds have elapsed.

P. M. DOWNING.

George Scarfe, electrical superintendent at Nevada City, has most of the mountain road records of that region of perilous drives. He ran his machine from the company's office in Nevada City up to the top of the grade above the powerhouse, six miles, in twenty minutes, and then speeded from the National Hotel in Nevada City over the ridge and to the railway station at Grass Valley in eleven minutes, beating the train in by seven minutes, after it had a nine minutes' start! No wonder those who ride with him exclaim, "Never again!"

Tinware may be made to look like new simply this way: Take common kitchen soda and rub it on the tin with a moistened newspaper; then polish the tin with a dry piece of newspaper.

Sour milk will remove iron rust from white goods.

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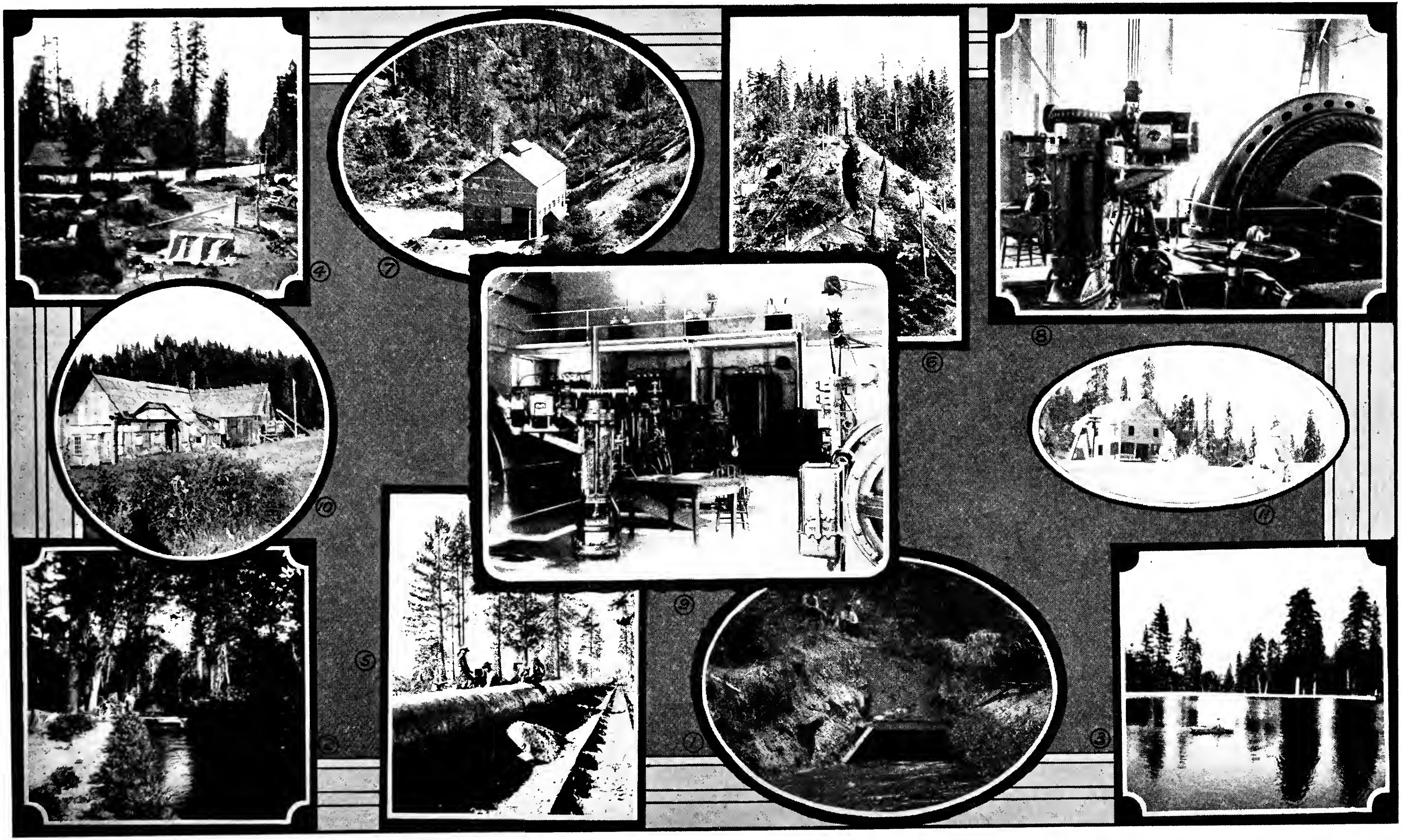


GLIMPSES OF THE DEER CREEK POWER PLANT

(1) Where Big Tunnel ditch emerges; (2) Canal coming into forebay reservoir; (3) Forebay reservoir; (4) Ditch-tender's home at reservoir; (5) Riveting the pipe before putting it underground; (6) Pipe-line trench down the ridge; (7) The power house [pipe-line enters at right]; (8) The generator; (9) The transformers; (10) Old sawmill shacks; (11) The foreman's house in winter garb

Pacific Gas and Electric Magazine

VOL. II AUGUST, 1910 No. 3

The Story of the Deer Creek Power Plant

By ARCHIE RICE.


Archie Rice

Water power is wherever it is developed. There are natural lofty falls, like those in the Yosemite, but generally man is debarred from using them for commercial purposes. After mining engineers inspected the Cripple Creek district in Colorado and reported that the geological formation was not right for gold, some ordinary, ignorant miners found Cripple Creek one of the richest auriferous deposits in the world! So there are men who will shrug their shoulders and say, "Gold is where you find it."

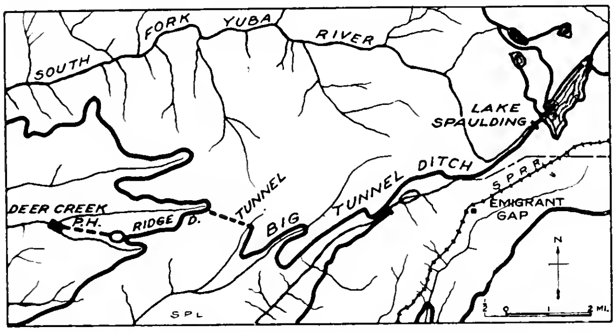
About fourteen miles northeasterly of Nevada City in Nevada County, up among the Sierra ridges of California, is the Deer Creek power plant. It is hidden away in the obscurity of a mountain region that has few visitors. Close to where it stands used to be an old sawmill. But after the woodsmen took their harvest of big timber from the slopes the district had no particular interest for any body else. Years went by. And a great opportunity waited to be discovered.

The simplest and cheapest hydraulic development in California lay there dormant till some one should see its possibilities. The Folsom power plant, twenty-two miles up the American River from Sacramento, began its pioneer productiveness in 1895. Even before that Eugene de Sabla had started work for the Nevada power plant, on the South Fork of the Yuba River, about six miles over a ridge and down a gorge to the northwestward of Nevada City, with a three-mile ditch system from a river dam upstream. While the builders struggled with their first dam and lost it in the flood waters and lost the chance of having the first power plant for long-distance transmission of electric energy, there was this Deer Creek possibility off in the other direction, with not half the work and with nearly five times the possible power. Only the engineers did n't happen to see it. Few people went over that way. But the Yuba River was a big suggestion of water power to any one.

In the days of miners' ditches, when hydraulic giants were turned to flush California hillsides away in a wholesale search for placer gold, there were many systems of mountain water developments. Off to the northeastward of Nevada City and Grass Valley are mountain lakes. They were tapped with ditches, meandering down to form the great South Yuba water system of canals and flumes for mines and for domestic and irrigating purposes. Out of Lake Spaulding a great ditch extended westerly toward Nevada City and pierced through a hill about a mile. Then part of its flow was carried on, and part was diverted into Deer Creek as a convenient channel to take it down toward

Grass Valley. That saved making a canal, and downstream a diverting channel conveyed it on again whither man desired it to go.

The old ditch men knew in a general way that the grade of that creek was rather steep. Some of them would "reckon" it must be a fall of two or three hundred feet, may be! And they let it go at that. The creek route



Location of Deer Creek Power House and Its Water Sources

was a convenience. The storage water from the chain of lakes was turned into that creek channel and then taken out again just where man wished to divert it.

Along in the year 1905 Frank G. Baum, at that time electrical superintendent for the California Gas and Electric Corporation, happened to be out prowling round looking over the company's water sources. He had studied the topographical maps, and he got to thinking that there must be quite a fall in that Deer Creek route. So he took an aneroid barometer and studied the altitude up at the tunnel mouth and where the waters were turned into the creek. Then he clambered along down the creek to where the water was taken out again. It seemed to him like something more than a nine-hundred-foot fall. He figured that all that was necessary was to make another canal from near the mouth of the tunnel and lead that flow gradually round to the top of a convenient ridge and then shoot the water down through a pipe to a power house to be erected on the bank of the creek.

It was a simple problem, considering the difficulties of most mountain hydraulic development work. No head dams were needed. No great physical obstacles were to be overcome. There was an abundance of water back in the lakes. Only a canal had to be made to the proper point. There a forebay reservoir could be scooped out and banked up. Then a pipe-line trench could be dug through the forest and down the steep ridge to the creek. The old sawmill road was still available, right in to where the power plant would be located. Easy? Why, it was like finding a gold mine with a ledge sticking out of the ground.

So the work of development was started by the Pacific Gas and Electric Company in the summer of 1906. Contracts were let: to the Schaw-Batcher Company of Sacramento for the pipe-line, to the Pelton Water Wheel Company for the impulse wheels, to the Westinghouse Company for the generator, and to the Stanley Company for the transformers. Then came a financial slump. Work was stopped. Nothing was done till the approach of the winter of 1907. When money became easily available things went with a rush. New demands had come upon the growing company for additional electric power. Deer Creek was needed in the system. Mud or no mud the heavy machinery had to go in right then over those mountain roads. In places near the proposed power plant the mud was so deep that the front wheels of the great wagons would sink to the axle and not revolve. The wheel horses had to be unhitched, and the wagons actually dragged along sled-fashion over the ooze. An old teamster who had boasted of muddy roads he had known remarked, "Over there in Nevada it got so bad sometimes I could only see the mules' ears sticking up, but on this dern job I only look for bubbles!"

The mud was so soft and deep that small pine trees were felled by the thousand, and their trunks laid side by side to form a corduroy road. More than five miles of that corrugated log surface was spread for the passage of the heavily loaded wagons.

Hauling the Deer Creek pipe in over the snow

A good deal of that old rumpled surface still remains. Unless you have ridden over a corduroy road you can have no conception of what the sensation is like. The horses must walk. At first, for a few yards, the motion is roughly suggestive of the nervous action of an old lady in a rocking-chair. Nor do you mind it. But as yards grow into rods and rods into miles and miles multiply, the jerking back and forth suggests an effort to bend your spine as you bend a piece of metal to the breaking point. It keeps you busy bowing. You become a blithering idiot, nodding approval to every log. After two hours of it you clinch your teeth to hold them in the gums. Your conscience has become so calloused that you actually approve of the driver's continued cursing of corduroy roads. The horses go thump, thump, thumping along over the slender logs, and the buggy whip jerks back and forth thousands of times. It gets tiresome. You fear to open your mouth lest your teeth shower out like so many white beans.

When you reach the power plant your host will say, "Why, I reckun you ought tuo come in by thuh lowuh road!"

You return by the lower road, luxuriating in its comparative smoothness, in its shade and in the majestic forest giants and the vari-colored splendors of wild blossoms and decorative foliage.

When you get back to Nevada City, late at night, not even a mining engineer in the hotel offiice, wearing a new suit of corduroy, can make you resentful or at all forgetful that you are as hungry as a long day and mountain air can make a man.

The Deer Creek power house is a solid-looking little cement building, right in the

acute angle of a Y described by the union of the two branches of Deer Creek that form the main stream. Back of the building the pine-grown slopes of the Sierras start up with a suddenness that suggests toboggan slides. Only you happen to be there, of course, when the sun is beating down into the vortex and the hillsides reflecting their heat through a shimmering surface atmosphere.

Then the tall, genial, young southerner who manages the station says: "See all that hillside they-uh by those old shacks? Well, suh, that they-uh is sawdust. It 's ten feet deep with sawdust. Used to be an old sawmill right they-uh, suh. Man named Coopuh owned it. He was the farth-uh of H. M. Coopuh, thuh company's managuh ovuh at Aubun. Snows good deal up heuh in wintuh. This heah-uh's thuh highest lectric plant in thuh company's whole system. Altitude of pow house is three thousan seven hundred feet. Las wintuh thuh boys dug uh hole in that they-uh sawdust an filled it plum full uv snow an covud it up. Why, we 've had snow, reguluh ice, fuh five months fuh ice-cream."

Putting in the Curve of the Deer Creek Pipe Line in Midwinter

You beam and collect a cottony dryness in your mouth. Then he dashes your hopes.

"Only just used thuh last uv it yestuday, suh. And now if yuh ready we 'll walk up tuh thuh resvoir. It 's only uh mile by thuh pipe-line, if you do n't mind uh lil walk up hill."

You look all round to see if you can 't spot the driver, who claimed he knew all the roads, and induce him to come along—that corduroy kink still in your spine. But he 's hidden safely away somewhere in a shady spot. So you tackle the slope, trailing along behind the man that is used to the altitude. You puff and perspire, and regret you did n't bring the driver.

Having raised yourself nearly a thousand feet and your temperature in proportion, you come out of the forest into a beautiful clearing rimmed with stately pines standing sentinel around a lovely little lake. Swim? Why, you could die in that lake! And then the superintendent bows a gallant southern courtesy, and you turn and see the ditch-tender's wife as she emerges upon the porch and nods pleasantly across lines of snowy washing. Swim? Well, may be up the canal, above the lake somewhere.

"You see this watuh goes down tuh thuh pow house an then they drink it down in Grass Valley, so weuh mighty careful bout keeping it clean and nice."

Swim? You compromise by scooping up a palmful and wetting your throbbing temples.

Now they did a great thing when they stopped turning the water into the creek channel. It used to go tumbling down a rocky, porous ravine. But nobody estimated the loss. When they made the new ditch and the reservoir they found they had in the diverting canal going to Grass Valley thirty per cent. more water than used to reach it. Seepage and evaporation had been stealing nearly a third of the volume by the creek route.

Four men in the company were particularly identified with the construction of the Deer Creek power plant. Frank G. Baum started the idea. James H. Wise had charge of the civil engineering problems. C. F. Adams supervised the electrical construction work. And A. L. Wilcox carried

through the details of the power-line from the plant over the ridges eastward to the Alta power house.

The Deer Creek plant was established to conform to a standard. Other and earlier plants had been constructed after the ideas of their various founders. When the great company bought and absorbed them it found it had many kinds and sizes of apparatus. At Deer Creek the big, single, generating unit was patterned after the units of the Colgate plant, so that in an emergency, with several plants having like parts, there could be sections readily available for transfer where most needed. The necessity came while the Deer Creek plant was being constructed. A bearing went to pieces over at the big plant at Electra. The Deer Creek bearing, being of the same standard size, was rushed over there, and thus a delay of several months was avoided in waiting for a new part to come out from the east.

Earlier penstock construction brought pipe-lines directly down to the back of power houses. There was an element of danger in such a scheme. A break in one of those mighty pipes might send torrents of water battering away at the building, undermining its foundations, wrecking valuable machinery in a few moments. So at Deer Creek the engineers brought the pipe-line down at a long tangent, and then gave it a curve to the westward near its lower end, where it finally forked Y-shape to produce two streams to play into the double set of water wheels, one attached to the projecting shaft on each side of the generator. If the long pipe-line coming down that hill at Deer Creek should ever break, the downrush of water will shoot off free and not menace the power house and its site.

Newest of all the eleven hydro-electric power houses in the company's great system of eleven mountain generating plants, the Deer Creek station is small, compact, simple, and fifth in kilowatt capacity. It has one big generator turning at three hundred revolutions a minute and producing 5,500 kilowatts; and three water-cooled and oil-insulated 2,000-kilowatt transformers. The transformers intensify the current by raising it from 2,300 volts to 60,000 volts, the pressure at which the power is transmitted way down to Sacramento. There the line unites with the main system. Another line goes over the ridges easterly to the Alta power house. There, through a bank of transformers, the Deer Creek power is again parallelled with the main system by connection with a 23,000-volt line from the Colgate power house.

In one corner of the Deer Creek power house is a small machine shop where most of the ordinary repair work can be done. The auxiliary apparatus of the station consists of a sixty-kilowatt, sixty-volt exciter, direct-connected to an impulse-type water wheel and an

PHYSICAL DATA	DEER CREEK POWER HOUSE
Capacity of storage reservoirs	1,975,568,000 cu. ft.
Area of storage reservoirs	2,160 acres
Miles of ditch and flume	19.5
Flow the second in ditch	100 cu. ft.
Pressure head (height of fall)	837 ft.
Force of water the square inch	360 lbs.
Number of impulse wheels	2
Capacity of generator in kilowatts	5,500
Total electrical horsepower	7,400
Generating voltage	2,300
Voltage on power-lines	60,000
Altitude at forebay reservoir	4,496 ft.
Altitude at power house	3,659 ft.
Size of power house	41 x 53 ft.
Material of building	Concrete walls, galvanized iron roof, steel frame.
Plant placed in service	May 6, 1908

eighty-five-horsepower induction motor. And there is a type Q Lombard governor, with oil pressure pump and tanks.

If you ever acquire a yearning to get away from the insistent demands of society, tire of theatre-parties and dinners and balls and crowds and all that sort of thing, go to Deer Creek. You will not meet even a brush rabbit on the road, going or coming. And when you get there you can spread your hammock under the pines and look up at the sizzling slopes and call faintly for more iced-cream. That is, unless you go there in winter. Then you will sit close up to the stove and sew a pair of socks on your old straw hat for earflaps before you venture out into the soft depths of "beautiful snow." But you will not be asking for iced-cream.

At the Company Picnic

THE girls provided the basket luncheons. There were about fifteen couples in the party. "Jack" Judge of C. L. Barrett's office in San Francisco got up the affair. And one day in September of 1908 they all went up to Camp Taylor, that beautiful wooded grove on the picturesque Russian River. There they spent a delightful day, all of them employees of the San Francisco Gas and Electric Company.

In the accompanying picture, which is only one of a large number of souvenir snap-shots taken of the outing, appear the following persons: (upper row)—E. W. Miles, Miss E. C. Gleeson, N. Golden, Miss Thompson, G. Menahan, C. E. Murphy, Miss M. Walsh, Miss E. Walsh, Miss E. Gastry, J. J. Cunningham, Mrs. J. J. Cunningham, Miss L. Seigel, W. Cavanaugh, Miss J. James, Edward Angelo, Jack Hyland; (lower group)—R. Discon, W. Weber, Miss E. Neumberg, Miss E. Stow, Miss T. Gilners, Thomas Gilners, Miss F. Kertill, J. Fitzgerald.

Genesis of the Gaselco Club

ONE day the boys of the collection department in San Francisco decided they would eat. So they chose a night in August of 1909, picked out an Italian restaurant up in the Barbary Coast district, to get the proper bohemian atmosphere, and selected J. J. Walsh, their chief, as the one nominally to be honored by the gathering. About twenty-five assembled and achieved a garlic breath. Some one softly breathed the suggestion that they make it a collectors' club. Others, their hearts possibly warmed to humanity by the "Dago red," thought it would be more brotherly to include the bookkeepers, or any body else in the headquarters building.

Eight months later, April 2d, 1910, the Gaselco Social Club had so far evolved from that original dinner that an initial banquet was held at an Italian restaurant on Stockton Street. The club had as its officers Louis Meyer, president; J. J. Cunningham, vice-president; F. E. Oldis, secretary; and J. J. Walsh, treasurer. About forty members gathered for the banquet, and the invited guests from the company were: John A. Britton, George C. Holberton, Charles L. Barrett, Archie Rice, Joseph D. Butler, and Larry Walsh. The accompanying illustration is from a flashlight photograph of the scene that night.

In the assembly room the first of May the club was reorganized, and D. A. White was again elected president; J. J. Cunningham, vice-president; and F. E. Oldis, secretary-

treasurer. The membership now consists of one hundred and forty-three men. The dues are twenty-five cents a month, and any man in the company may affiliate. Each member is given a small book containing the printed by-laws and spaces in which are written his payments as they are made.

Labor Day in California will come this year the fifth of September, a Monday. The Gaselco Social Club will blossom big that day. It is to have a barbecue near Mountain View, about forty miles down the peninsula from San Francisco. Private cars on Southern Pacific trains and private cars on the suburban system will convey the club members and their guests down the line and bring them home again.

There are to be about three hundred people at the barbecue, and it will be held in private grounds in a beauty spot where a creek meanders through and great trees make liberal shade.

For the coming winter season the club is looking forward to having a dance or a theatre party or a dinner, or possibly all three.

Among its members the club has talent that may be used to entertain. Louis Meyer is a singer and pianist; E. Wantz, a cello player; L. Melbourne, a violinist; Eddie Murphy and C. Dragecevich are cornetists; Willis Egan, a baritone singer; Fred Collins, a singer of English costermonger songs; and Sam Wardlaw, a monologuist and former professional actor. A. R.

Service-Connection Charge in New York

WHAT charges should be made for running service pipes and service wires into consumers' residences has been defined in New York state recently by the Public Service Commission of the second district.

Where the main is already in the street and within one hundred feet of the premises to be supplied, then, so the commission ruled, it would be reasonable for the gas company to bear the cost of the service pipe and the laying of it from the main to the curb; and the consumer to pay the actual expense of the pipe and the labor of laying it from the curb to the meter. But if an arbitrary charge of so much a running foot for the extension from the curb to the meter were made and proved satisfactory to both consumer and company the consumer should still have the right to demand the bill for the actual cost of his part of the work.

Where the main is already in the street, but more than one hundred feet from the premises desiring service, or where the main is not in the street and has not yet been brought to within one hundred feet of the premises the commission has the power, given it this year by the New York legislature, to require the company to extend its mains. But the commission announces that it will exercise its discretion as to the reasonableness of ordering each such extension and exercising such large powers.

It also ruled that even where the premises are already wired for electricity at the time the application is made for gas service the company should charge for curb-to-house extension; and it should desist from the practice of installing service pipes from curb-line to house free of charge where the house is not wired for electricity and where the consumer obviously intends to use gas only. The cost of such installations, the commission announced, could be graded or apportioned on the basis of gas consumed or to be consumed.

Playing Winning Ball

SOME good baseball has been overlooked. The annual game between the heads of departments of the Pacific and San Francisco companies got all the limelight.

The regular team of the San Francisco Gas and Electric Company has played and won five games straight this season. At Fort Baker, on the northern side of the Golden Gate, there is a soldier team that has been playing good baseball. It had a record of twenty-four consecutive victories and no defeats. Then the company's team tackled that outfit, and the soldiers took their first fall, 9–6. On Yerba Buena Island the naval training station maintains a team from the pick of its several hundred husky and agile young men. That team had a record. The company's nine tried it, and administered a defeat, 5–0, the only time the prospective men-o'-warsmen have been shut out this season. Then there was a return game, and at the end of ten innings the company had the better of that, 8–7. Also, the company's nine played the Gas Workers' Union in San Francisco, and won, 2–1.

Saturday, August 6th, the Presidio soldier team was taken on for a game.

The result was an 8–5 victory for the gas and electric boys.

The character of the playing has been such as to promise that with aroused and unified ambition to turn the trick the company's team could go out and get the amateur championship of the state and perhaps of the Pacific coast.

There have not been enough games to bring out the best possibilities in the organization. But plans have been made for a schedule that will give two Saturday games and two Sunday games a month during the rest of the season. Out-of-town games will be played in places about San Francisco Bay.

Later there is to be a match with the Olympic Club of San Francisco, which has some 2,000 members from whom to select material. And an effort will be made to get a game with the Wasada University team from Japan, during its tour of this country. This university sent a team to America several years ago, when baseball was first starting to get a wonderful grip on Japan. Now the Japs can play ball.

Who make up the company team? Scanlan, a messenger, pitches. "Sarah" Hall, a draughtsman in the gas engineering department, and Eddie Murphy, a statement-taker in the gas department, are the catchers. The basemen are Willis Egan, a gas counter clerk and brother of Dick Egan of the Cincinnati Nationals; Al. Trowbridge, assistant civil engineer and former Stanford varsity captain; Steele of the draughting department; and Sullivan, a clerk in the purchasing department, who also acts as manager and coach. The other fielders are Feeney, a gas statement-taker; Mensing, a statistical clerk in the president's office; Hefferman, a bookkeeper in the auditing department; Winkle, a bookkeeper in the statement-taking department; and Barthold, a stenographer in Secretary Foote's office.

When the college baseball season opens the team expects to get a game with the University of California varsity.

D. W. Rathbun of the electric construction department is the father of Miss Elizabeth Catherine Rathbun, born at San Rafael, May 11th, 1910.

Leon B. Jones, superintendent at Martin station and son of E. C. Jones, is to be "experience editor" this year during the annual meeting of the Pacific Coast Gas Association at Los Angeles the 20th, 21st, and 22d of September. The association has more than two hundred and eighty members, of whom fifty-six are in this company.

A Substation Poet

THERE are men who strive for things that are ever just beyond their reach. But the striving does them good. They try to do what they like to do. The early training may have been lacking. Desire may have come late in life. Musicians, painters, poets are not developed in middle age. Schooling is a necessary period of preparation.

The great poets have been men of scholastic training. Words were their instruments. Vocabulary comes from knowledge and use of words. Poetry is an expression of sentiment in metric phrases, nicely measured and balanced so that the syllables follow one another in harmony, while carrying a strong thought beautifully expressed.

Many people can agree on what is good prose, but there is a great diversity of opinion concerning what is put in verse. In serious form it is often an object of suspicion.

There is a man past middle life, in charge of Substation J, down on Sacramento Street in San Francisco. In the long hours of his loneliness there with only the constant loud humming of the electric transformers he amuses himself by putting some of his thoughts into verse form. He came from Germany as a youngster, and learned the trade of piano and organ building in Philadelphia. But his father and all his brothers had been German soldiers. So in 1867 he ran away and enlisted in the Second Cavalry, and went with the troops out to frontier posts of the middle west. He was chief trumpeter with the regimental band, and in '71 was detailed with the escort and was made special orderly to the Grand Duke Alexis of Russia, when that celebrity was visiting Red Willow Springs. One day the Grand Duke ordered him to ride out to head off two buffaloes that were evading the hunting parties by running up an arroyo. The lone trooper was thus met out of bounds by General Phil Sheridan. The general struck him over the shoulder with the flat of his sword, ordered him to dismount, unsaddle, and carry his saddle back to barracks. But presently the regimental adjutant got the straight of the situation and informed Sheridan. That doughty commander, quick to anger but also quick to admit a fault, went to the trooper and apologized, and ordered him to saddle and remount. Later that bugler sounded taps over the grave of General Rodman, the inventor of the Rodman gun, when the remains were brought from California and buried under a great oak on the Mississippi's bank, at Rock Island.

In '76 the former bugler helped install the first electric lighting plant established in Salt Lake City. He drifted west, went with the expectant tide of humanity to the Coeur d' Alene mines, came back disappointed, and entered the railroad shops at Sacramento, where he invented a sleeping-car ventilator. And in 1892 he designed and produced for the California State Fair an exhibit for the federated trades that won him a gold medal, which he presented to his union with his resignation, because of aroused jealousies. Then came the railroad strike in '94, and he was taunted with not being a friend of unionism. So he quit his good position, and went out with the sympathetic strikers; and in a few months he had lost all his possessions, including several thousand dollars in property. He began again as a conductor on the Sacramento cars, and finally secured electric station positions at Sacramento and then at San Francisco, gradually going the rounds through several substations that are now a part of the company's system.

So there is the outline of the life history of Fred C. Birkenstock, who spends his spare moments in trying to put stray thoughts into verse, where other men might simply whittle a stick or play solitaire.—The Editor.

MY CALIFORNIA!

Thou land where rose forever blooms,
And softest tints touch azure skies,
Against thy shores an ocean booms
And golden sunset never dies.
My California!

Thou art the land God's bounty bless'd.
Thy very soil has virgin gold.
Thy flora, grain, and fruits attest
Thou art rich favored in this world.
My California!

Land of the patri't whose warm blood
Is ever at his country's call
When foreign foes in warring flood
Make threat to tread thy sacred soil.
My California!

Thou art the land of zephyr's breath.
And songs of love and happiness
Will come to my departing soul
Because of all thou giv'st to bless.
My California!

A PAGE IN THE LIFE OF A BROOK

Tumbling over mossy banks,
Murm'ring through the leafy glades,
Playing with the sands of Time,
Nestling in the dappled shades.

Dashing under frowning cliffs,
Threading channels dark and hoar,
Gliding to a precipice,
Leaping then quite sprightly o'er.

Idling through a meadow green,
Stealing sky's rich azure hue,
Splashing from an ancient wheel,
Seeking millpond, turquoise blue.

Running on with rhythmic flow,
Hast'ning down where hills divide,
Passing delta's marsh-grown reeds,
Mingling then with ocean's tide.

"CONSERVATION?"

Was n't talk of conservation
When the west was land of luck.
On "the plains" roamed buffalo;
From each crag sprang fine young buck.

I mind when trains would have to stop
To let that bison horde surge by;
When antelope would skip and hop
And frolic in the grass knee-high.

I 've watched the elk come down the trail,
By scores in splendid cavalcade;
Range proudly 'round the water-hole,
While bucks fight-fury made.

But all that now is history;
That wealth of life is gone for good.
Nor is the process mystery:
Behold it now in waste of wood!

There was no thought of conservation
When the redman still held sway.
The settler 'lone made cabin home,
But the savage gained the day.

Now they talk of guarding treasures,
When the greatest have been grabbed,
And the source of bounty wasted,
And the nation's vitals stabbed.

The Magazine in Book Form

Volume one of the PACIFIC GAS AND ELECTRIC MAGAZINE has been bound. It makes a big book ten inches long, seven inches wide, and about an inch and a half thick. It contains four hundred and eighty pages of reading matter, the aggregate of all that was in the twelve monthly numbers.

A good many individuals sent in their saved numbers and had a volume bound along with the company's order at the minimum cost of sixty-five cents a volume. Altogether one hundred and thirty volumes were bound in smooth buckram cloth of a soft gray tone. Every district manager's office and every electrical superintendent's office has been provided with a bound volume for the permanent use of the office for reference or for any business purpose that may arise.

George Holzberger, an electrician's helper, who was recently injured at Station A in Oakland and was incapacitated for some time, is now fully recovered. He was fastening some bolts on a switchboard panel, accidently dropped the wrench he was using, and it grounded a circuit-breaker, the resulting flash burning him upon the hands.

John McCarthy, a foreman in the gas department in San Francisco, was injured July 20th by being struck by a passing wagon as he was directing work in a trench at Fifteenth and Mission Streets. He was hurled into the trench and severely bruised, but is now well on the road to recovery. He has been in the service of the company twenty years, and is well known and liked among his associate employees.

Lighting Rates in 58 American Cities

	Population	Cents the kilowatt hour	Remarks
Atlanta, Ga.	150,000	9	Water power.
Albuquerque, N. M.	10,000	13.5	
Baltimore, Md.	650,000	10	Cheap fuel.
Birmingham, Ala.	60,000	10.4	
Boise City, Idaho	20,000	15	
Boston, Mass.	630,000	11	
Brooklyn, N. Y.	1,600,000	12	
Buffalo, N. Y.	415,000	9	Water power; 5% discount for cash.
Burlington, Vt.	22,000	10	
Butte, Mont.	65,000	11.8	Water power.
Chicago, Ill.	2,600,000	12	Cheap fuel.
Cheyene, Wyo.	20,000	12	
Cincinnati, Ohio	460,000	10	5% dis. for cash.
Cleveland, Ohio	550,000	12.5	
Denver, Colo.	230,000	8	Water power; cheap fuel.
Des Moines, Iowa	100,000	12	5% dis. for cash.
Detroit, Mich.	450,000	12.6	
Fargo, N. D.	15,000	10	
Grand Rapids, Mich.	110,000	8	Water power; 10% added for delayed pay.
Guthrie, Okla.	23,000	15	
Hartford, Conn.	100,000	11	5% dis. for cash.
Houston, Texas	100,000	13	5% dis. for cash.
Indianapolis, Ind.	250,000	10	Cheap fuel.
Kansas City, Mo.	375,000	10	Cheap fuel.
Little Rock, Ark.	60,000	13.5	
Los Angeles, Cal.	350,000	7	Cheap fuel.
Louisville, Ky.	290,000	8.4	
Madison, Wis.	26,000	14.5	
Manchester, N. H.	70,000	12	5% dis. for cash.
Memphis, Tenn.	200,000	10	
Milwaukee, Wis.	375,000	12	5% dis. for cash.
Minneapolis, Minn.	310,000	10	Water power.
Natchez, Miss.	18,000	13.5	
Newark, N. J.	350,000	10	
New Orleans, La.	375,000	17.1	
New York, N. Y.	3,000,000	10	
Oakland, Cal.	200,000	9	Water power.
Omaha, Neb.	150,000	14	5% dis. for cash.
Philadelphia, Pa.	1,500,000	13.5	Cheap fuel.
Pittsburg, Pa.	600,000	10	Cheap fuel.
Portland, Me.	65,000	9	
Portland, Ore.	275,000	15	Water power; 5% dis. for cash.
Providence, R. I.	215,000	12	
Raleigh, N. C.	18,000	13.5	
Richmond, Va.	116,000	10	Water power.
Rochester, N. Y.	200,000	8	Water power; 5% dis. for cash.
St. Louis, Mo.	750,000	12	
St. Paul, Minn.	235,000	13.5	
Sacramento, Cal.	55,000	9	Water power.
San Antonio, Texas	125,000	14.5	
San Francisco, Cal.	500,000	9	Water power.
Salt Lake, Utah	100,000	10	Water power.
Spokane, Wash.	85,000	10	Water power; cheap fuel.
Seattle, Wash.	200,000	9	Water power; 10% added for delayed pay.
Sioux Falls, S. D.	15,000	18	
Topeka, Kan.	50,000	9	Cheap fuel.
Washington, D. C.	350,000	10	10% added for delayed pay.
Wheeling, W. Va.	50,000	13.5	Cheap fuel.

The average rate, omitting Los Angeles, which is close to oil fields, is, for the fifty-seven cities, 11.4 cents a kilowatt hour. Only Denver, Grand Rapids, Louisville, and Rochester are cheaper than Oakland, San Francisco, or Sacramento, cities served by the Pacific Gas and Electric Company, and forty-five cities charge more. The table was first published in the Electrical World, July 14, 1910.

Electric Transmission Troubles

By C. F. ADAMS, Engineer of Electric Construction.

PART IV

C. F. Adams

When the total length of the entire transmission line is considered, the percentage of trouble due to line faults is surprisingly low. Consider the length of line exposed and the total number of insulators subject to breakage as well as mechanical failure. There are nearly 1,800 miles of line and probably 220,000 insulators in this company's system.

Many readers are familiar with the story of the 60,000-volt insulator. The famous two-part "water spout" type was one of the first designs. This was found to be safe in the foothills, but a failure in the valleys, particularly in the fog districts. Many of this type are still in service in the foothill districts of Butte County.

Failure came from puncture through the top of the insulator, and also by creepage over the outer surface. The lower glass petticoat was changed to porcelain, and a second petticoat was added. Later the original cap was changed in form for one of larger diameter, fourteen and sixteen inches being the final dimensions. A third petticoat was finally added, and the standard, four-part, California-type insulator thus evolved is considered the best vertical type insulator made.

It is interesting to note that an eastern power company recently changed all its triple-petticoat top insulators to the four-part type and thereby avoided practically all failures from lightning puncture.

Many of the failures of insulators are due solely to dust accumulations, the insulator

Type of poles and insulators sustaining long span near the De Sabla power house

Suspension Type of Insulator

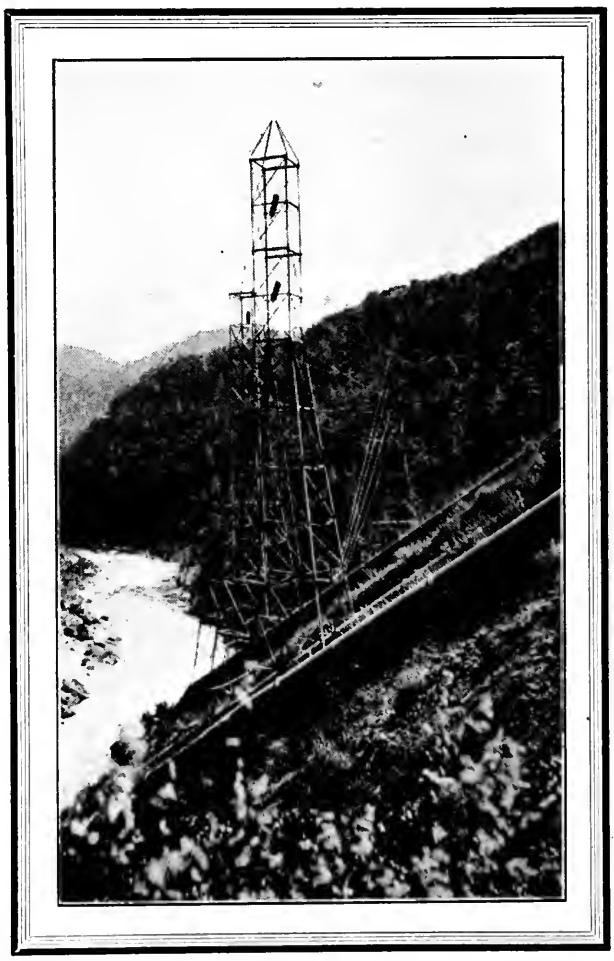
being otherwise perfect. Better to illustrate this point, the original eleven-inch, 60,000-volt insulator can not be depended on for constant service on 11,000-volt lines in the fog districts. A slight leakage, infinitely small, will in time crease and carbonize a wooden pin or cross-arm, and fire will result. Wooden pins are now practically obselete, and wooden cross-arms are marked for early abandonment.

The only remedy for dust troubles is to have parallel lines, and at intervals to cut out one line and clean off the dust from insulator surfaces. Hope is entertained that the suspension-type insulator will be trouble-proof in this respect. At least two years' service in the fog districts will be required to demonstrate the ultimate value of the suspension insulator.

The long spans used on the tower lines reduce the number of insulators. The higher lines used in tower construction and their wider separation promise some immunity from certain mechanical interferences to which pole-lines are subject. Some form of tower-supported line is being adopted by all the later systems, the item of pole wear and depreciation being a strong factor in this choice.

The log book of any division manager will supply a formidable list of line trouble-makers. Early lines were given a spread of about forty inches in order to reduce line induction to a low value.

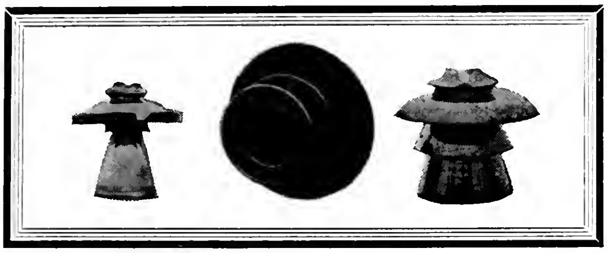
Owls, hawks, eagles, blue cranes, geese, swans, and pelicans all tested these lines to their sorrow and ours. Turkeys, ground squirrels, and house cats tried to perch on in-



Initial towers, where power-line starts from power house at Big Bend on Feather River

sulators and had a brilliant finish. All of the possible accidents have occured, and the impossible accident has not yet been determined.

Lines of a later date were given a spacing of sixty, seventy-two, and eighty-four inches,



Insulators of the water-spout, the sixteen-inch, and the four-part California-type

dependent on the length of the span. On these wide-spaced lines the bird troubles are very few.

In the higher hills, snow is a factor, and heavier lines and stronger supports are needed.

The line material has been much debated. All commercial types of wire and cable are in use. Copper, aluminum, and steel are used, both the solid and the stranded conductor being employed. The low melting point of aluminum is the chief weakness of this metal, as an arc will cut off an aluminum line long before a copper line would fail under similar trouble. Line construction materials and methods have followed the laws of evolution. Each year sees some new advance toward greater strength and safety.

The problem of electric transmission from the mountain streams is very largely a problem of line construction and maintenance.

The future power houses on the Pacific coast will be either steam or hydraulic, dependent on the complete solution of the practical problems involved in the high-tension line.

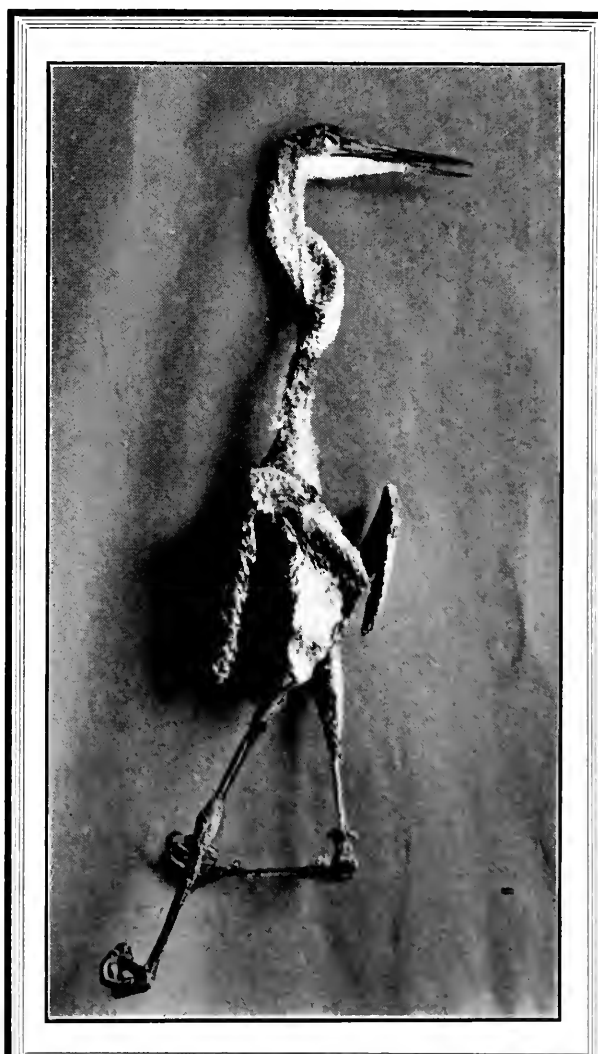
H. P. Pitts, an employee of the Bay Counties Power Company who came to California to assist in the construction of the Colgate plant, returned to the service of the company August 1st, after an absence of two years.

It Was a Bird!

THE evening of July 7th, at nine minutes past eight o'clock, a blue crane "shorted" the 60,000-volt line that carries the power from Electra to communities about San Francisco Bay. It immediately became necessary for Electra to separate from the line in order to protect its machinery from the heavy current thus thrown upon it.

The line was tested a minute and a half later and found O. K., so service was again established.

A few minutes after the trouble Electra was notified by telephone that there was a fire on the pole-line just opposite Valley Springs and that men had already gone to fight it. Upon the receipt of this message



This Is Not the Company's Stork!

two men started from Electra for the scene of the trouble, which was at the other end of twenty, crooked miles of steep, rocky road. On arriving at a point where the pole-line crosses the wagon-road, opposite Valley Springs, they began to look for signs of fire, but could find nothing of the sort except the smell of burned straw. Following the line to the north for half a mile through dry grass knee high, they came upon a burned spot, probably about two acres in area. The fire had been cornered there and put out by the prompt action of residents of Valley Springs.

An inspection of the line there revealed a broken insulator, although the cable was still in place. On the ground nearby was found a badly scorched crane, where it had fallen like a torch, setting fire to the dry grass after "shorting" the line.

The power was taken off the line between three and four o'clock the next morning, so that men might replace the broken insulator with a new one. It was discovered that two tie-wires had been burned in two by the arc that broke the insulator.

A photograph was taken of the unfortunate bird that "got it in the neck" and everywhere else. Its toes remained curved just as they gripped the wires.

ALEX MORAN,
First Operator, Electra Power House.

Electric Talks

I. Magnets and Magnetism

By JOSEPH P. BALOUN, Head of Draughting Department.


Joseph P. Baloun

The word magnet is derived from a mineral named magnetite, which is an ore by nature, and which, beside having a certain chemical composition, possesses peculiar properties. If a long, narrow piece of the ore be taken and plunged into some iron filings they will adhere to it, at the two ends very heavily, and gradually less in amount as they approach the middle of the length of the bar, where there will be none, as in Fig. 1. If, however, we take this piece of ore and suspend it by a thread, so as to allow it to move freely, it will be seen that it will immediately take a practically north and south position. For this important property this mineral is called a lodestone (a leading stone), or a natural magnet. This valuable feature, of pointing always to a particular direction, was discovered centuries ago by the Chinese, and was used in navigating their ships.

Now, magnetic cures were in the olden days really supposed by the learned physicians of those times to be caused by the aid of the magnet, which, it was believed, had valuable influences in the alleviation of certain pains and ailments of some persons. This theory has long since been exploded, and this practice of deceit and delusion in the use of the magnet has fortunately been abandoned. The value of electro-magnetism, or magno-electricity, as it is also called, is quite another though valuable phenomen now, and is recognized by the medical world of today.

If the extreme end of the lodestone be rubbed several times over the surface of a small piece of steel bar it will communicate its magnetic property to the bar and give it a power that it had not before. A bar so


Fig. 1


Fig. 2

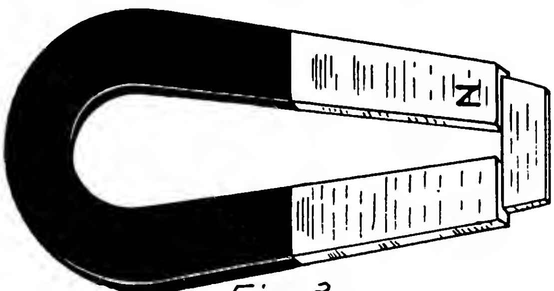


Fig. 3

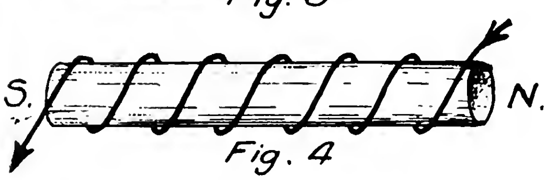


Fig. 4

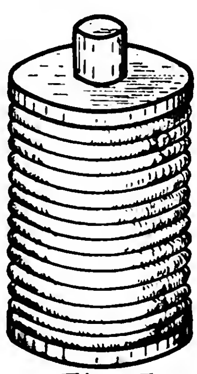


Fig. 5

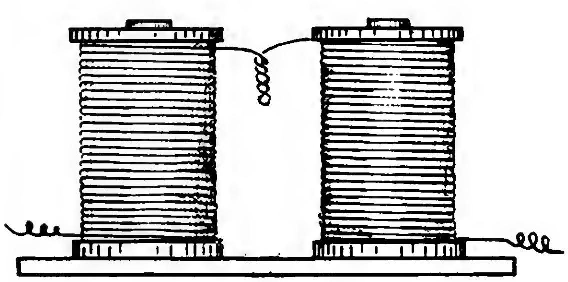


Fig. 6

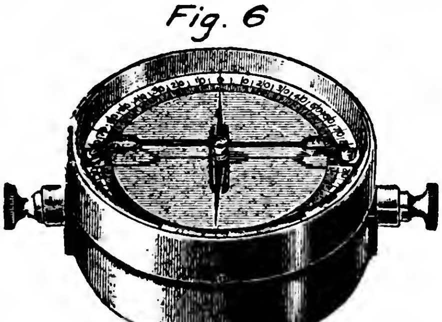


Fig 7

magnetized is shown in Fig. 2, iron filings adhering. Thus the steel bar has become magnetized; it has become an artificial magnet. This artificial magnet now possesses the same three properties as the natural magnet, or lodestone: first, it attracts iron; second, when suspended very freely, it will take a particular position; and third, when the ends are rubbed along a piece of steel it will make that steel a magnet. It is true that in practice our powerful artificial magnets are not made from lodestone, but by superior methods to be explained later.

The ends of both kinds of magnets are the points where the attraction for iron is the strongest; and at the middle, or neutral point, there is absolutely none.

If the bar magnet be bent to the form of a horseshoe, either end will attract the iron; but if both ends be permitted to touch at the same time, the attraction is multiplied many times more than when using either end alone on the iron, see Fig. 3.

The ends of a bar magnet are called its poles, and these are termed the north pole and the south pole, according to that particular position to which the ends will point when the bar is freely suspended.

If two magnets are brought together so that the north end of one bar approaches the south end of the other bar, they will attract each other. If the two same, or like, ends of the bars are brought together, they will be found to repel each other. In other words, like poles repel, and unlike poles attract each other.

If a number of turns of insulated wire be wrapped around an unmagnetized steel bar, and a current of electricity from a dynamo or battery be passed through the coil, the steel bar will become permanently magnetized, and it will possess the north and south poles after the current is turned off and the wire coil removed. See Fig. 4.

Instead of winding the wire on the bar, if the bar be inserted in a spool of insulated

wire, then a more effective magnet can be made. See Fig. 5. This spool of wire with its bar slipped in place and the current turned on becomes an electro-magnet. This electro-magnet may be substituted for our permanent steel magnets in making other magnets. If two of these electro-magnets be connected together at one end with a bar, then they will make a horseshoe electro-magnet, as in Fig. 6.

All qualities of steel are not equal in their value for making the best magnets. Many of the brands of steel plate magnetize most easily but they do not retain the magnetism for any period of time. Steel containing various percentages of other alloys can not be made to magnetize at all. A fine, close-grained steel, such as is used for machine-tool steel, makes the best permanent magnet, though it will require the longest time to magnetize.

All permanent steel magnets are materially weakened by subjecting their surfaces to shocks, such as the action of repeated blows from a sledge hammer. If the magnet be heated to a high temperature and then again tested for magnetism, it will be found to have lost practically all of it. The action of strong acids on the surface of magnets entirely neutralizes the magnetism therein. We infer from these instances of weakness of magnets that their surfaces must be preserved to keep them strongly magnetized. Thus a compound, bar-steel, permanent magnet, made up of thin pieces of steel separately magnetized, is far stronger than one of solid steel of equal dimensions. These compound magnets, especially when made up of laminated horseshoe magnets, are used extensively in electrical testing and measuring instruments, and for various classes of magneto-electric apparatus.

A valuable application of the permanent bar-steel magnet is the magnetic needle, which is made from a piece of magnetized steel in the form of an index pointer, in the centre of which, after most perfect balancing, a small jewel, glass, or other bearing is inserted so as to allow it to swing freely to its particular position of north and south when at rest. Electrcial detecting instruments, such as Fig. 7, or magnetic compass apparatus, use this magnetic needle.

For the reason that steel bars, or keepers, are placed across the two poles of a horseshoe magnet before putting it away for a time, so should the unlike ends of several bar magnets always be kept together to prevent loss of magnetism.

Much adjusting is often required on a ship's compass to compensate for the errors introduced on the movement of the magnetic needle by the influence of the ship's steel hull, the metal work in the vicinity of the compass, or by the electrical conductors, such as the wiring, and other things.

(To be continued.)

An order has been issued, effective from August 4th, requiring the use of none other than "safety" matches in all departments and by all employees while engaged in those departments. It is a precaution against fire risk, following accidents caused by the use of "parlor" matches.

Through the public spirit of the Weinstocks of Sacramento, the University of California has a fund that provides eminent speakers to deliver what are designated as the Barbara Weinstock Lectures on the Morals of Trade. Two of these discourses have come to us in book form from the presses of the Houghton-Mifflin Company of Boston. One deals with "The Conflict Between Private Monopoly and Good Citizenship" as expressed by John Graham Brooks, president of the National Consumers League, contains about 5,000 words, and costs fifty cents; the other is a discussion of "Commercialism and Journalism" by Hamilton Holt, managing editor of "The Independent," contains about 13,000 words, and costs a dollar and a half.

How Walking Helps the Office Man

By JOSEPH D. BUTLER, Auditor San Francisco Company.

Joseph D. Butler

Walking has been found by the writer to be the best possible tonic to his physical system, giving the pleasant and buoyant feeling of the joy of living and a desire to battle with the problems of every-day life. A walk, particularly before breakfast, produces the most beneficial results. Of course, consideration must be given to one's physical condition. After a hard winter's office work, in the month of February or March, a man finds himself below par as it were, not up to his standard mentally or physically.

The method pursued to tone up is the following. The first morning a half hour's time is given, which means about two miles. If a longer time be taken harm will come instead of benefit. Do too much at first and that exhilirating feeling which should stay with one all day will not come after the bath. Instead, one will feel as if the exercise had done him no good. After a few more mornings the walk may be increased to one hour. It should not be merely a ramble, but should be as rapid as can be maintained. At the end of two weeks the walk should be taken every other morning until the winter season again sets in.

One must be dressed warmer than usual, that is a heavy woolen sweater should be used. This will tend to bring out the perspiration. Upon returning to the place of starting a cold bath should be taken. Then there will be no danger of catching cold. When stepping into the bath, if the sponge or cloth be dampened thoroughly and placed at the base of the brain shock to the system and also a headache for the rest of the day will be prevented.

When ready for breakfast, no medicine or other tonic will be needed to spur the appetite. Nature will have performed her work by means of the large quantities of pure air that have been inhaled and by the throwing off through the pores of the skin of the poisons that were in the system.

After three or four months of walking the stomach will be stronger. One will then be able, during the time of exercise, to run slowly at short intervals. This will tend to work up the heart and lungs gently, and also will aid in bringing on quick perspiration.

I have done as much as sixteen miles before breakfast without feeling any ill effects. This, of course, should not be followed regularly, it being too severe on the system. In this instance, however, I was unable, being in the country, to obtain breakfast before seven o'clock, and, as I intended to take a long trip, I had to start at least two hours before seven.

I have had a number of men out at different seasons in the many years of my walking experience. The most notable example of the good effects of a walk before breakfast, with deep inspirations of the good and pure air at sunrise, was the case of a man who arrived at the place where I was spending my vacation. He had come out of a sanitorium a few days before. He breathed in short gasps, giving one the impression that it would be a long time before he would be able to return to the city in fairly good health.

Upon my return from a walk I was hailed by a guest, "How far?" The usual response, "a mile or two" was my answer. This caught the attention of the invalid from the sanitorium.

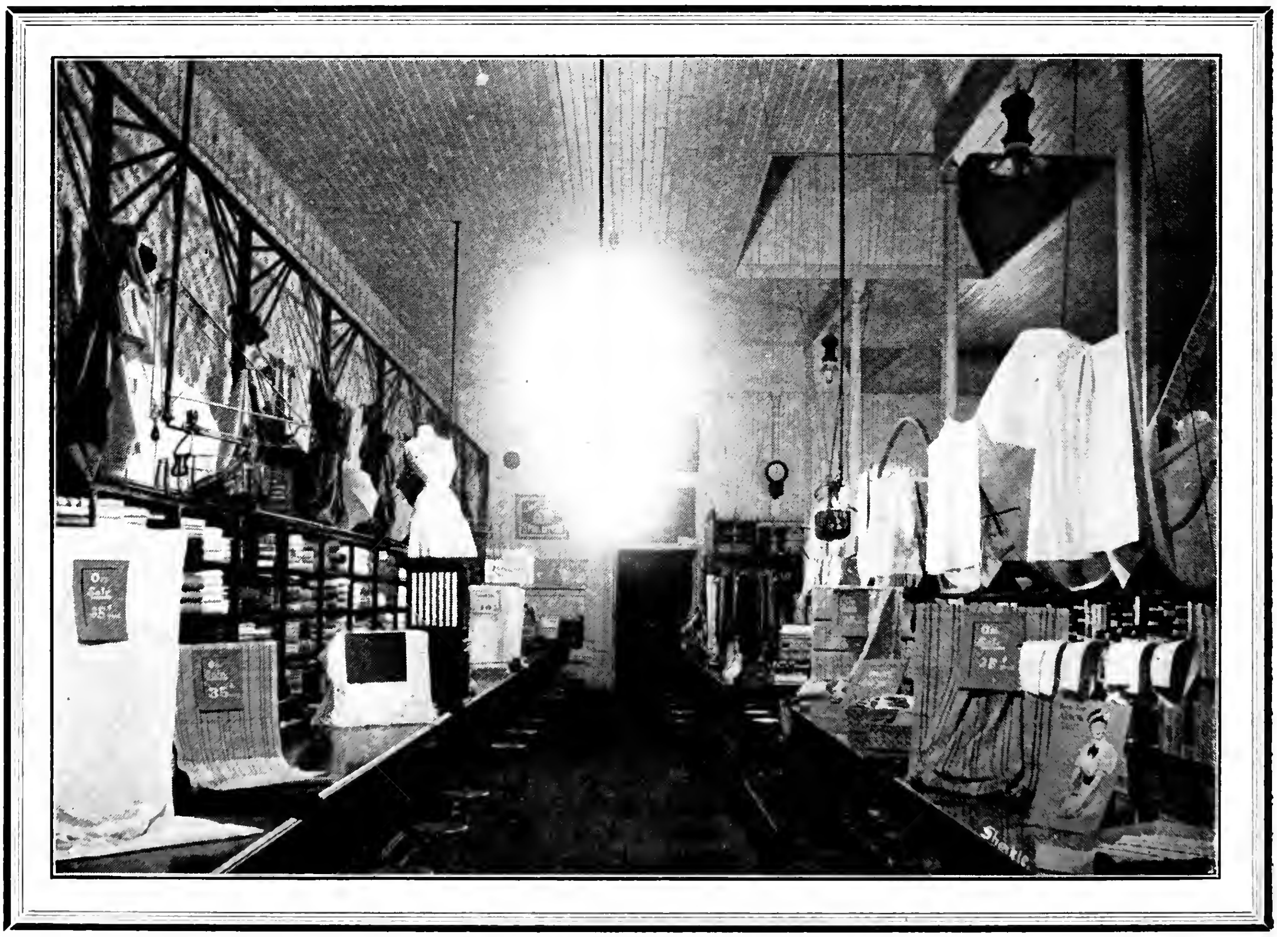
A very pleasant conversation ensued as to physical culture and particularly the good effects of a walk in moderation before breakfast, the accompanying deep breathing was

such an aid for folks feeling worn out or "all in."

This invalid had arrived a Tuesday morning. Wednesday morning he was taken out for a walk that lasted about a half hour. He was told to try and breathe slowly and deeply while walking. This was very difficult for him to do in his condition. Upon his return, however, he felt very much better. That night he did not feel at all well, although during the day his eyes were much clearer. They had lost the dull look that appeared in them at first.

Thursday, Friday, and Saturday the morning walks before breakfast were continued. The Saturday after his arrival he also walked after breakfast two miles to the next town, and returned before luncheon. That afternoon he and a companion walked at least three miles to a farm and then returned the same way to the starting point. Thus he had accomplished ten miles for the day, a very good and amazing result, considering his health.

I left the following Sunday morning, after he had had but a few morning walks, but his improved condition was quite evident to others as well as to himself.



This is a picture taken at night. It is the interior of a dry-goods store at Woodland. All the light obtained for this photograph was produced by gas arcs, which appear as white blurs midway over the aisle. The object in reproducing this photograph is to illustrate how well every detail is brought out by this nearest approach to daylight. It is a little demonstration of what may be done with the proper use of gas as a store illuminant. The photograph was sent in by W. E. Osborn, manager of the Woodland district.

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EDITORIAL

Where Conscience Is the Judge

Some one—he may have been philosopher or cynic — has claimed that eight out of every ten children are unwelcome, undesired. To that prenatal handicap is attributed much of the unreasonableness and unworthiness of those growing and grown to maturity. The sins of the parents are visited upon the next generation. They come back like a boomerang upon the parents themselves.

Most every great good man of the world had a mother who was a good woman. Nancy Hanks, the mother of Abraham Lincoln, was an inspiration producing nobility of character in her son, born in poverty but reared in purity and love.

Many of the worthiest achievements of man are attributable to the coöperating and sympathizing influence of a good wife.

Inebriety and excesses give the world much of its hidden harvest of idiots and imbeciles. For such there is no hope.

Illicit love has often produced children of great mentality. But always there is the tincture of evil, the tendency to crime, the malign influence of an immoral motherhood damning the child far into later life.

Where there is love and respect and right, parents endow their offspring with the best possibilities. And in middle life and through old age the parents of such children reap their reward.

Old-age has its loveliness and its charm when life has been lived right. It shows in the countenance of him or her who has come on to the years of white hair and can wear that mantle of purity and look the part.

Respect is an inspiration to right-living. Ridicule and rebuffs induce a kind of cowardice. They attack the foundation of self-respect.

Most of us become what people think we are. If we get started right and encouraged we develop. If we waver and go wrong and try to amend one wrong by another we degenerate. Life is not a standstill. We go forward or we go backward. Each progress is power gained for renewed effort. Every retreat from the right weakens our moral defenses.

A time comes when retreat is a habit. We drift, and the world is full of drifters. They make up the army of incompetents, the social and the criminal problems, that confront every large community and patrol the roads with tramps. As some one has phrased it—any old dead fish can float down stream, but it takes a live one to go against the current.

Where there is a conscience there is a chance. Conscience is that other-self in us prompting us to be square, to play fair. It is that self-judgment that makes real artists their own severest critics. They know when they have done something good, produced something worthy. And then there is joy in their work. A thing well done pleases the doer.

The good in us comes from within. How to bring forth and encourage the latent elements of good in each individual is one of the great problems of life. Mostly we leave it to some woman school teacher. She struggles with fifty such problems at a time. Not being endowed with the personal interest of motherhood, she must, in the very nature of things, give least care and love to those wayward and rebellious little natures that most need to be turned away from their manifest tendencies.

MEN OF THE COMPANY

JOSEPH C. LOVE

Scotchman, Naval-cadet, Book-keeper, and now Chief Auditor; Father of Ten and Grandfather of Two Children

THE greatness of a nation depends upon the intelligence of its people. Numbers without intellect have never yet made a mighty race. Down through the ages brain and not brawn has been the conquering, the progressive force. And only those races that produced artists, sculptors, writers have left the lasting records by which can be judged the condition of intelligence to which their people attained.

Greece is a little nation, and Ireland, and Scotland. They are small territorially, and each has only about three million people. But you can happen upon some obscure outpost of civilization, at the ends of the earth, and everywhere you can find a Scotchman running a little business making money. Too easy conditions do not produce a rugged race. Where climate is balmy and existence no exertion the people are indolent. Representatives of a swifter and more energetic life come among them and eventually take their wealth of lands and possessions and leave the natives impoverished and victims for the diseases of those that have lost their grip.

Joseph Charles Love

Scotland is a hard little land. No emigrant ever went to Scotland to settle. Nobody but a Scotchman could make a living there. Norway is agriculturally and climatically forbidding, but the harsh conditions have bred a tenacious and valorous race.

The greatest cities of the world are not along the zone of climatic luxury. London, Paris, Berlin, St. Petersburg, New York, Chicago are all far to the north, in the world-belt that girdles Seattle. San Francisco is further south than any large city in Europe.

Hard conditions make a hardy race. Enforced thrift develops brain power. Brains achieve in the business of life, in the arts and refinements that distinguish civilization.

So Scotland produced writers and poets. And the world knows Scotland and her highland scenery.

More tourists go to Scotland to visit the

birthplace of "Bobby" Burns than all those who seek the shrine of England's Shakespeare. Burns had the gift of poetry and a personality that made many women love him. Out of his numerous transient love affairs came his appealing verses. He lived at high tension, and died at thirty-seven.

Burns was born at Ayr, Scotland, in 1759. Of the town he sang, "Ayr, toon wha nane surpasses for honest men and bonnie lasses." And J. C. Love was also born there at Ayr, nearly one hundred years later. It was New Year's day, 1857, when the Loves' bairn arrived. He spent his early boyhood where "Bobby" Burns lived his youth and received the inspirations that have made sentimental women love "Bobby" Burns these one hundred and thirty years. Burns and love seem almost synonymous terms for Ayr.

Love himself visited the home of Burns, and later danced on his "Twa Brigs of Ayr" and roamed his "Banks and Braes o' Bonnie Doon."

In the days when Love was young Ayr was a little town about the size, as he expresses it, of Nevada City or San Rafael. It was a place of one business street. The town blended into the surrounding fields of a rolling country side. And the farmers raised grain. They also raised about all they ate, fruit, vegetables, and so on. Ayrshire cattle take their name from that locality. But Love ruthlessly punctures a pretty poetical sentiment when he declares: "You can see more kilts at a Scotch picnic in San Francisco than you can in all Scotland today. In the highlands they wear tweeds and plain homespun; you see little of the fancy plaids, excepting in England's highland regiments. And the bagpipe! I would n't have one of those things in my home."

At an early age the subject of this sketch left the "auld toon of Ayr," and took up his abode in the city of Glasgow, where he attended private school until the age of thirteen. Then he entered the Mechanics' Institute of Arts and Sciences, and he began the study of accounting. During that period he worked evenings from six to eight o'clock and all day Saturdays in a large mercantile house, checking daily sales, cash balances. Thus he got his first experience in practical office work. After finishing school he spent one year in the office of the City Attorney of Glasgow, and afterward was in an iron works for a short period.

When he came to the age of sixteen Love did not fall in love as did "Bobby" and produce a poem. No, he enlisted in the navy and turned his back on Scotland and her lissom lassies and the joyous haymaking, where the Scottish custom pairs man and maid to make work a pleasure and get the hay in before it rains. For three years Love was on the sea as a naval cadet in the British service, cruising in the mild Mediterranean and in the bleaker Baltic.

The wanderdlust had got into his brain. He was twenty when he started for America, headed for Lawrence, Massachusetts. He secured a position as bookkeeper in a large weaving mills, and he stayed with the job five years.

Then he made a move across the continent to San Francisco, and secured a position as bookkeeper for a railroad contractor, another Scotchman named James Scobie, who was at that time constructing the bridgework of the California and Oregon Railway from Redding in California to Ashland in Oregon. He put in a year up there in the Siskiyou mountain country. Returning to San Francisco, he entered the office of Balfour, Guthrie, and Company, a big grain, shipping and fire and marine insurance concern, a staple Scotch firm with head offices in Liverpool, England, but represented in the leading ports of the world. The Scotch are clannish and cling together. Fourteen years was the measure of his experience with Balfour, Guthrie, and Company. Then he put in four

years as bookkeeper for George Dornin, who was in the fire insurance business in San Francisco.

Thus he came to the year 1901 and the age of forty-four. It was then that John Martin started the California Central Gas and Electric Company, to supply the towns

Little lady Love, whose *pere* at Ayr, like "Bobby" Burns,
In Scotland grew, your grace, like lace, goes well with ferns!

of Grass Valley, Nevada City, Marysville, Chico, and later Woodland. And Love began as bookkeeper, opened the first set of books for the concern, and was nominally its first president. He remained with the corporation until it expanded and absorbed other companies. Then he was made traveling auditor. He continued in that capacity till August of 1907, when he was appointed to the position of chief auditor of the Pacific Gas and Electric Company, which has grown with his advancement and his intimate experience with its business branches.

All Scotchmen are not big and brawny; nor are they all sandy, with a pinkish tinge of hair. Andrew Carnegie is physically but not financially short. J. C. Love is not so big as "Andy" either way, and he says himself that he has not worn kilts since he was ten. But you can catch the brogue as he talks, and when you learn that he is the father of ten children (six of whom are living) and of two grandchildren, that he is a thirty-second-degree Mason and honorary member of the Pacific Coast Horticultural Society, that at his home in Berkeley he has two greenhouses and a splendid collection of a hundred varieties of ferns from New Zealand, Hawaii, England, and this country, and that he has a tender fondness for beautiful roses and other flowers you have to admit there's something in a name. What Ayr did for "Bobby" Burns it must have done in some degree for this father of many children.

He now scrutinizes the expenditures of a great corporation serving a California territory as large as Scotland.

Brain has done the business of the world, and love has been the inspiration that has produced the things of beauty and civilizing refinement. A. R.

George W. Merrill has resigned the superintendency of the Sacramento street-car system. When he entered the company seven or eight years ago it was to occupy a minor position; and he rose to be superintendent, first of twenty-one cars and latterly he controlled an equipment that under his care had expanded to forty cars, with one hundred and eighty workmen. He was succeeded August 1st by N. J. Hullin, who has been employed in the car service a number of years, latterly in charge of railway construction, so that his promotion is in the nature of a reward for faithful performance.

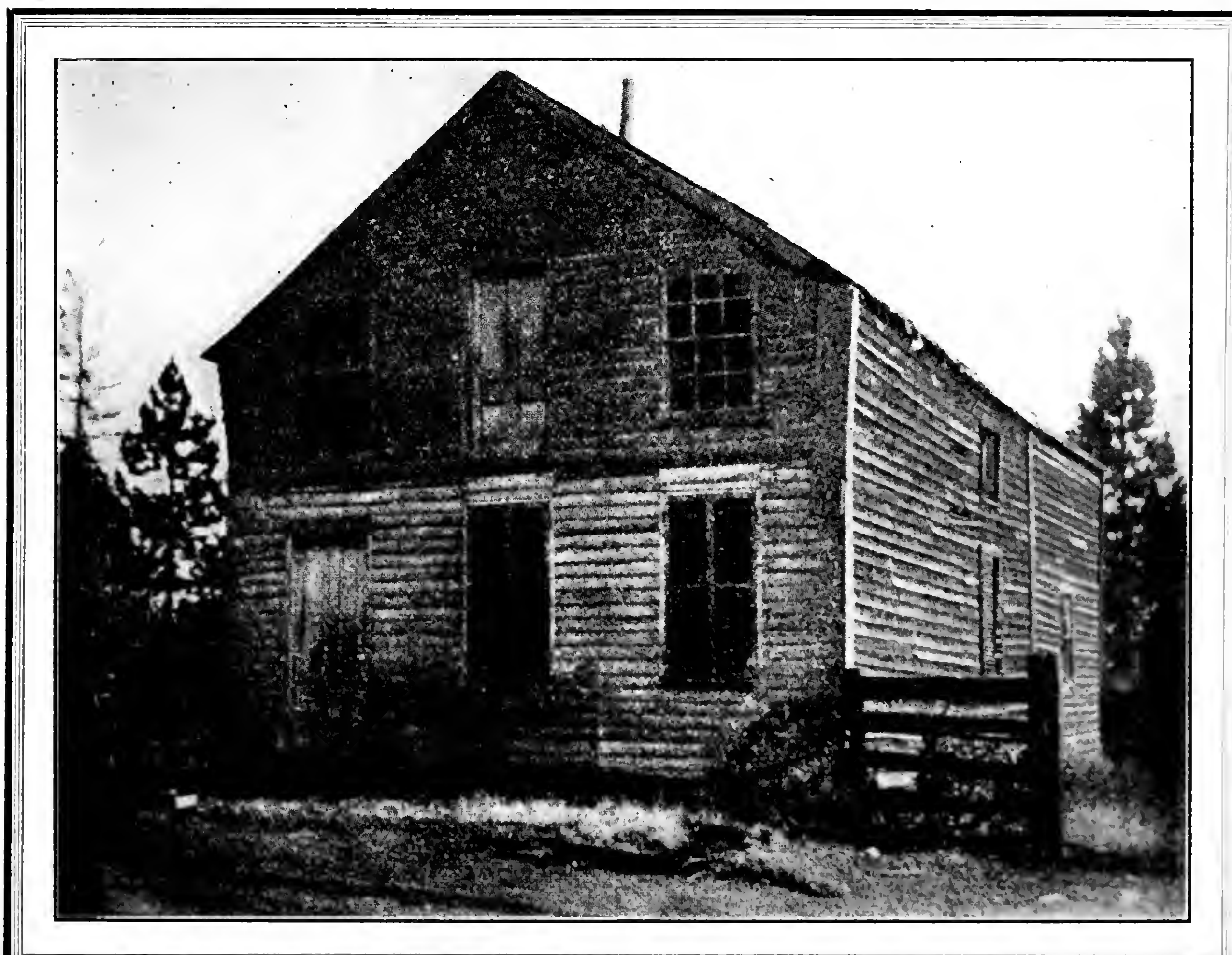
Where the Stanford Fortune was Started

THE start of the Stanford fortune of more than $30,000,000 was made in a split-shake shack in El Dorado County, California. For half a century after Stanford vacated it that flimsy little building stood there high on the slopes of the Sierra, surviving the elements, until just a few years ago, when a fire blotted it off the landscape.

On the main transcontinental railroad line of the Central Pacific, a few miles northward of Auburn, is the little town of Applegate. About fourteen miles due east of Applegate, across rough, ridgy country, without roads, is a place called Mount Gregory. It is at an altitude of more than 3,500 feet, on a high ridge, the northward side of which slopes steeply down to the south fork of the middle fork of the north fork of the American River, while the southward side descends more than a mile to Missouri Cañon.

In pioneer mining days Mount Gregory was a little settlement. To the westward about a mile was Mount Hope, another mining camp, and about two miles further westward was Volcanoville. Round to the southeastward from Mount Gregory was Kentucky Flat, on the wagon-road running in a crescent-curve southward some twenty-five miles to Placerville.

Mount Gregory and those other names near it are places of the pioneer past. They are memories among the surviving few men who knew them during the romantic reign of the red-shirted gold-hunter.



The Mining Camp Store where Stanford Started His Millions

The Stanford family came to America from England in 1644, and it has continuously resided in the United States for the past two hundred and sixty-six years. Leland Stanford was born on his father's farm near Watervliet, New York, March 9th, 1824. He attended the country school, and when he was twenty he went up to Albany to study law in an office. At twenty-four, after he had been admitted to the bar, he went way out to Wisconsin, which was going far in those days, and settled in the town of Port Washington. After he had been there a year and had established himself as a young lawyer in a new place he went back to New York state to wed the young girl who had promised to be his wife, Miss Jane Lathrop, a member of an old and prominent family of Albany, New York.

For several years they lived at Port Washington. Then a fire came in the night and destroyed all Stanford's law books and the possessions of a young household. Stanford was then nearly twenty-eight. Should he stay in that little Wisconsin town with his young wife and try to build up from nothing, or go way out to alluring California, where two of his elder brothers were already doing well keeping a merchandise store in Sacramento?

He chose California; took his wife back to Albany; and started across the plains. He arrived in California July 12th, 1852, and from Sacramento went directly up into El Dorado County, where things were booming. He bought out a small merchandise store at Mount Gregory and soon after erected a larger building, the one shown in the illustration, putting on the shakes, it is said, with his own hands. From the time he was twenty-eight till he was thirty-two he lived there at Mount Gregory, keeping a general merchandise store in that split-shake building. It looked just as the picture shows it, except that in the old store days there was a porch across the front for the loitering miners to sit down to discuss the news and chewing tobacco. He dealt in about everything a miner could buy, from shoes to shovels, from salve to shirts.

During those four years Leland Stanford made a small fortune in that little store. Then he moved down to Sacramento and established a big hardware and merchandise business on the capital he had accumulated up in the mining country. Also he sent for his wife, and she came out to California by steamer route and the Isthmus of Tehauntepec.

During his first year in Sacramento he helped organize the new Republican party. When he was only thirty-three he was nominated for state treasurer. But the new party was weak in numbers, and he and all the other Republican candidates were defeated. When he was thirty-five he was made the Republican nominee for governor, but the party was again defeated.

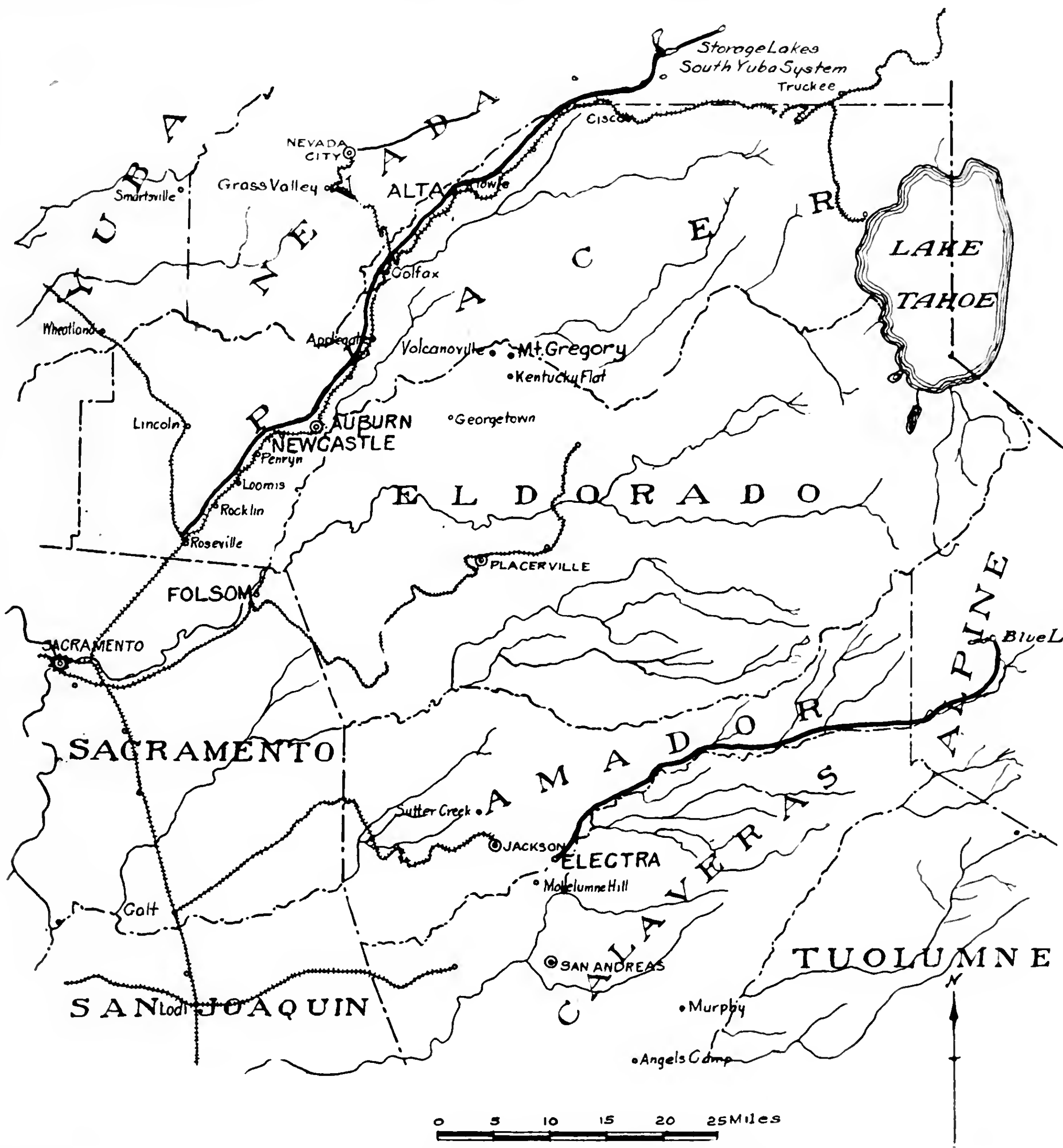
In 1860, when he was thirty-six, he was sent as a California delegate to the Republican national convention at Chicago. There he gained the friendship of Abraham Lincoln, and he went on to Washington as Lincoln's guest. Upon his return to California he found himself already nominated for governor. And he was elected California's first Republican governor, when he was thirty-seven, receiving 56,000 votes to his opponent's 23,000.

In 1861, the year he was elected governor, he was also elected president of the prospective Central Pacific Railroad Company, which he conceived and organized with Charles Crocker, Mark Hopkins, and Collis P. Huntington, each of whom died worth more than $20,000,000. These four men, all of Sacramento, with a comparatively small combined capital, secured concessions of government land, borrowed money on the prospect, built the road, sold the land to settlers, and in the next quarter century achieved fortunes from the commercial development of the

greatly productive territory Leland Stanford's project had opened to the public. Experts had said that a railroad could not be put through the Sierras, but Stanford went ahead.

Twenty years after he had been war governor of California, at the time when watchfulness saved California to the Union, Stanford was elected United States senator, and then was re-elected.

During the two decades between his governorship and his senatorship he had acquired great ranches in different parts of California. He was a judge of good land, and seemed to have visions into the future. When he took his old friend Gage up on bleak Nob Hill one day and said here he would build himself a home, and swept his hand out and remarked he could see the time when great railroads would come across the continent into San Francisco and the ships of all maritime nations would come into that bay for California's products, Gage thought he was a dreamer. But Stanford bought the Vina ranch of 55,000 acres in Tehama County, which has 7,000 acres in vines, the largest vineyard in the world; the Gridley ranch of 21,000 acres in Butte County, the



Showing the Location of the Company's Alta, Auburn, Newcastle, and Electra Power Plants and their water sources and canals, and Mt. Gregory, where Stanford had his store

largest wheat farm in the world; and the Palo Alto ranch in Santa Clara and San Mateo Counties, an area of 8,400 acres, comprising the Stanford University campus of today. And he bought much other land.

It was at the Palo Alto ranch that Senator Stanford perfected experiments that gained him recognition as the foremost horse-breeder in the world. He crossed speed with stamina and produced a line of trotters that made and remade more world's records than any other breeding farm has ever rivaled.

He had a way of thinking out big plans and carrying them through to success. Whatever he took hold of he did well. His ranches were models of neatness and well-kept order. His stock farms and racing stables were in advance of others of the time.

Then he conceived the idea, after his sixteen-year-old boy died in Italy of fever, of doing something different with his great fortune, and his wife coöperated in the plan. So, Stanford University was founded. "A liberal education is the birthright of every American citizen," he said, and "the children of California shall be my children." And so, in time $33,000,000 went into that university that has in its nineteen years given free education to more than 10,000 men and women.

It happened to be the good fortune of the writer to be of the first class to enter and complete the four-year course at that university, to be among those few in the early collegiate days who had opportunities to talk with Leland Stanford and know his kindliness and simplicity; and it also happened to fall to the writer's lot to send out to the world the first newspaper story of the death of Leland Stanford, lawyer, merchant, railroad president, war governor, senator, multimillionaire, founder of Stanford University, one of the biggest men in California's history.

A. R.

More Gas Territory Reached

A complete gas-distribution system for the city of Richmond was started in August, and will mean an expenditure by this company of about $50,000. Richmond is a manufacturing and oil-refining community of about 10,000 population, and is within the jurisdiction of the company's Oakland and Berkeley districts.

Three miles of high-pressure pipe is being laid this August to supply gas distribution from the Oakland works to the Suburban Light and Power Company, which serves as far away as Hayward.

Both these extensions will provide gas service to very large and growing districts.

There is a ditch-tender at the Alta power plant 6 feet 6¼ inches tall.

What an existence! In summer he 's a baseball umpire; in winter, a complaint clerk in the gas company's office. "Robber! Thief!"

The company's Marin district is laying twelve miles of new gas mains from San Rafael to San Anselmo and Ross and is remodeling the source of the gas supply.

An increase of twenty-five cents a day in the wages of electrical workers, affecting the company's payroll to the extent of an addition of about $150,000 a year, was decided upon in San Francisco Friday, July 22d, at a meeting between officials of the company and the Pacific District Council of the Electrical Workers. The rate was made effective from June 1st.

A typical camp spot in a California forest

Vacations

Joseph P. Baloun, head of the draughting department, spent his vacation by tramping from San Anselmo to Cazadero. He was accompanied by his eldest son, aged twelve. They carried all their blankets, provisions, and equipment, the boy packing eighteen pounds and his father thirty-five. They slept out every night, caught trout along the way, went in bathing in creeks and in Tomales Bay, crossed on one hundred and ten railway trestles on the way up, explored several old Indian mounds, and took five dozen photographs of scenes along the route of the Northwestern Pacific Railroad. They came back satisfied, happy, and refreshed.

J. U. Smith of the draughting department went up to Truckee and Tahoe by train, taking along his bicycle. He wheeled part way around Lake Tahoe, pedaled over the divide to Walker Lake, visited old friends, went fishing and swimming in Nevada streams, and the fourth of July picked wild strawberries and also plucked some icicles that were nearly twelve inches long.

H. L. Raymond of the draughting department put in his outing by camping at the Italian-Swiss Colony a mile and a half from Asti. He went rowing and swimming and for the owner of the place broke a four-year-old filly to ride. The fourth of July was hot, but there was a big campers' dinner and lots of fun.

F. W. Brown of the draughting department put in the time at Tomales Bay, and

fished for smelt, salmon, halibut, and rock ccd by trolling and with gill nets. There were also swimming and sailing, horseback riding, autoing, and hunting cotton-tail rabbits.

A. B. Hall, a draughtsman in the gas engineering department in San Francisco, spent his vacation early in August deer-hunting near Fort Bragg.

C. F. Adams, engineer of electric construction, has some interesting photographic studies that he is proudly exhibiting as proof that he enjoyed the beauties of the Yosemite while taking a short summer's vacation.

H. C. Vensano, civil engineer, chose Lake Tahoe as a place of recreation, and spent his time at Emerald Bay and Fallen Leaf Lake.

Municipal Ownership in Vienna

WHAT has happened under a comprehensive system of municipal ownership in the Austrian capital city of Vienna is interestingly related in the June number of the Bulletin of the League of American Municipalities. Excerpts from that article, in so far as they deal with the gas and electric business, are reproduced herewth.

Under the somewhat despotic rule of its recently deceased burgomaster, Dr. Karl Lueger, Vienna has developed municipal cwnership to a degree far beyond that of any other great capital.

The first and most important undertaking acquired by Dr. Lueger was the street-railway system, which formerly belonged to the Vienna tramway company. To gain this property the burgomaster carried on a long and bitter fight with the stockholders, who finally were forced to part with their interest at a loss of hundreds of thousands of dollars. This was in 1903.

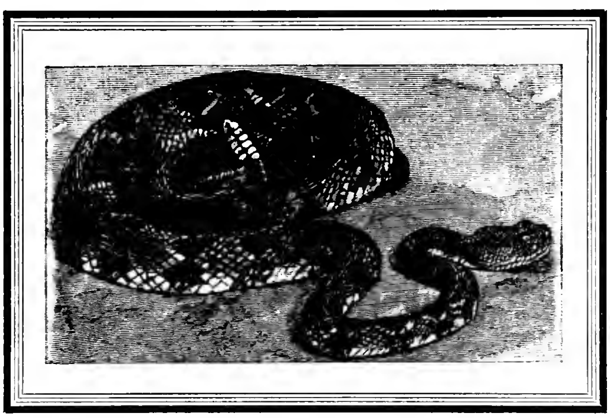
Altogether the city has now invested $28,000,000 and greatly developed and improved the service for an average yearly return of about $500,000. This is considerably less than the city would have received, without any investment at all, from the old company, the charter of which provided for the payment to the municipality of 9.8 per cent. of the gross earnings. This showing is less satisfactory, too, as the traffic has increased enormously and the fares have been raised all around, much to the digust of the taxpayers. It is to be noted that the municipal tramways escape taxes of about $200,000 a year which the old companv had to pay.

Following the taking over of the tramways came the erection of municipal electric works at a cost of $12,000,000. Again, after a disagreeable fight with the stockholders the city bought out two private companies for a total of $5,000,000. Last year the electrical works showed a clean profit of $1,000,000, but this was largely achieved by making the tramways pay a most exorbitant price for the power supplied. The original estimate for the power plant was exceeded by nearly $5,000,000, and the consumers have never received any reduction in price for electric light, as they would have done had the private companies continued in business.

In converting Vienna's gas works into a municipal plant Dr. Lueger once more trampled on the rights of the original owners, stockholders of an English corporation, absolutely refusing to take over any of the property at the expiration of their concession. Instead of enlarging and developing the existing plant of the English company, which was quite good and satisfactory, he involved the city in an immense outlay for new work. Although the municipal gas plant showed a profit last year of $700,000 the consumers have gained nothing from the city's ownership. Gas for all purposes, lighting, heating, and power, costs in Vienna 3.2 cents a cubic meter (about 97 cents for one thousand cubic feet), and is the dearest gas in all Europe, with the exception of Paris.

Rattlesnake Bites and Cures

PEOPLE will tell you that the rattles cn a rattlesnake denote the years of its age. Mark that down as a fallacy. It is like the nice, old, historical myth that "the eternal city" of Rome was founded by Romulus and Remus, infants suckled by a she-wolf! The rattlesnake sheds its skin once or as many as four times a year. Every time the skin is shed another rattle appears. Occasionally rattles are broken off or lost at the extreme end, and that snake may, by popular rating, be reckoned younger than it is. Among some old Californians, particularly the cattlemen with a tinge of Spanish blood in their veins, there has survived a tradition amounting to a belief that the rattles themselves contain a fine dust, which will destroy the eyesight of a human being. Such old-timers may caution a "gringo" not to wear rattles on a sombrero, lest by chance they get broken and some of that insiduous dust reach the wearer's eye. The only poison about a rattlesnake is in a gland in the reptile's head. The rattles are absolutely harmless unless you insist upon handling them while they are attached to a live snake.



In all the vast territory of California, throughout its eight hundred miles of length and some two hundred miles of width, the rattlesnake is the only poisonous reptile. California's lizards are all harmless. All the snakes in California are absolutely harmless except the rattlesnake.

But there are five different kinds of rattlesnakes within the confines of California. Do n't worry. Four of the five kinds are never found north of the Tehachapi. They fall to the lot of southern California.

The Pacific Rattlesnake, sometimes called the black rattlesnake, is found all over California, except on the Mojave and Colorado deserts; that is, it is found in places where civilization has not yet stamped it out. But the day of the rattlesnake is going. The Pacific Rattlesnake is common in Lake County, the western part of San Bernadino County, parts of Santa Clara and Monterey Counties, and lots of other places. It is rather dark in color, sometimes a kind of green; it has dark blotches on the back rimmed with lighter areas. But individual snakes of the same kind differ considerably in coloring.

Then there is the Red Diamond Rattlesnake. It is found only in the western part of San Diego County in California, but it is common over the border down in Baja California. It is bright reddish yellow, and is the largest of all the rattlesnakes found in California.

Also there is the Sidewinder, or Horned Rattlesnake. It lives only in the Mojave and Colorado desert country of California, but is found over the border in neighboring Nevada and Arizona. It is a very pale ash gray in color, and is distinguishable by little horns over the eyes.

Next comes the Tiger Rattlesnake, so called by reason of the resemblance of its markings to the cross stripes of a tiger. It is tawny yellowish in color.

Lastly there is Mitchell's Rattlesnake, found in California only in the Colorado desert region, that area where the map shows

Indio, Palm Springs, and the Imperial Valley. Its real home is Baja California, but it ranges up into the southern desert end of California and over also into the neighboring parts of Arizona. This rattlesnake was named for Dr. S. Weir Mitchell, novelist, naturalist, physician, and one time American authority on snake venons. How 'd you like to have a rattlesnake named after you?

A great many people insist that the so-called corral snake in California is poisonous. The real corral snake is venomous. But it is not found in California. Its territory is Texas, Arizona, New Mexico, the gulf states and most of Mexico and even way down into South America. The California snake that some call a corral snake is easily noticeable for its alternating rings of black and white or red and white, encircling it like bands about an inch wide. But it has no power to harm.

Now for the Pacific Rattlesnake, which may be encountered nearly any place in California, particularly in warm and rocky regions. You want to know how it attacks and what to do if a person be bitten.

First know this: rattlesnake bites result in death in only about one case out of ten. That is the average. The percentage of fatalities is greatest among children, for the simple reason that a child's body is smaller and the amount of venom is relatively greater for the bulk affected.

A rattlesnake bites only when it has to bite. It prefers to run away. It will bite when attacked, when cornered, and when suddenly surprised and too near to escape. It usually rattles a warning if it hears you coming.

A rattler can strike and inject venom only three or four times in succession. Then its supply of poison is for a time exhausted. But after about half an hour the sac containing the poison secretes another supply, and the snake is ready for business again. In a big rattler these poison glands hold as much as half a tablespoonful of venom. The poison is a yellowish white fluid, something like the white of an egg, only not quite so firm. The snake does not waste its poison, as that is its only means of defense; it will not bite aimlessly. But it will bite any time it has to, day or night, and with deliberate aim, excepting only when it is shedding its skin and the skin is temporarily pulled down over its eyes. Then it strikes out blindly.

Let us see what happens when a rattlesnake bites a person. It strikes; its two downward curved needle-like fangs pierce the flesh and inject the venom. Results then depend a good deeal upon just what spot on the body is bitten and upon the amount of venom injected. If the fangs penetrate a large vein that vein will the more easily carry the poison right along toward the heart. But if the venom strike the shin bone or where there is little tissue or few veins the chances are better.

The arteries and veins of the human body are akin to the water system and the sewer system of a great city. The heart is the big, powerful pumping works forcing fresh arterial blood through the mains for the use of tens of thousands of consumers. The veins are the sewer pipes draining the waste matter and impure water back to the lungs, which are the purifying works. And so the round goes endlessly on, as long as the heart pumps. The arteries are pressure pipes. Their little branches reaching out through the tissues are called arterioles. They are the small service pipes to the consumers. Tiny muscles keep these arterioles contracted to small orifices, and the heart has to pump vigorously to force the blood through.

The instant effect of a rattlesnake bite is to relax the tiny muscles that hold the arterioles contracted to small orifices. So the service pipes swell. Then it is easier for the blood to pass through; it flows more slowly; and the heart beats decrease in force. There is n't enough pressure in the service pipes to

get a full supply of blood up into the brain; and the person becomes giddy and faints. That faint may last an hour, or even twenty-four hours. It all depends upon where the venom was injected and how much.

The first thing to do in case of a rattlesnake bite is to take a knife and quickly slash open the spot bitten and then apply the mouth and suck blood and venom out and spit it away. In the next few seconds a handkerchief or a stout strip of cloth should be tied about the limb loosely, between the bite and the heart, and a stick inserted and the circlet of cloth quickly twisted and twisted very tight to check the flow of any remaining venom toward the heart. And then some one should be sent in a hurry for a doctor. The doctor will inject strichnia or some such heart stimulant to overcome the sluggish action induced by the venom.

Whiskey is not the thing for snake bites. This will be a bitter blow to amateur fishermen and hunters and husbands who have always taken along a large supply. If no doctor be available and the wound be slashed and sucked, then a very little whiskey may be administered, never to exceed two tablespoonfuls every three hours for a day following the bite. More whiskey than that given after a snake bite is dangerous to the life of the patient, though a good deal depends upon how much of anything some constitutions can stand, be it snake venom or heart stimulant.

Ordinarily the venom is absorbed into the tissues within the first three to five minutes. Acute conditions will develop within the first few hours. As soon as the patient begins to feel better the worst is generally past. If the subject get sick and then get better these stages will be gone through within the first ten or fifteen hours. After that there need be no great apprehension. The flesh will discolor around the wound like a black and blue bruise, and in bad cases there will be considerable swelling. The local effect of the venom is to destroy the natural immunity of the tissue at that point. It becomes easily liable to infection and to bloodpoisoning from microbes that would naturally find no lodgement. So, even after the snake venom, or most of it, is sucked out there is danger of the wound developing bloodpoisoning.

Although I have had the grim pleasure of killing a good many California rattlesnakes, with sticks and stones and shotgun, I am not presuming to present this little treatise out of my own experience or knowledge. What is here given for the good it may do employees scattered through the great area of the company's system is based on the information of a snake expert, who has studied California reptiles for a great many years and who has for long been connected with the California Academy of Sciences, Dr. John Van Denburgh of San Francisco.

Also, I have it from Dr. Rupert Blue, the United States government expert on contagious epidemics — yellow fever, bubonic plague, and the like—that whiskey is one of the worst things that a man can take for snake bite. What Dr. Blue prescribes is this: Slash open the wound, suck out the venom; then soak into the cut tissue a solution of permanganate of potash. This is a powerful antiseptic. It comes in tiny discs as you buy it at any drugstore. Water should be added until the dissolved tablets produce a liquid about the color of claret wine. That is strong enough. A little of this solution can be carried in a very small bottle by any one having occasion to be about in a snake country, either for his own use or for the emergency need of others. The permanganate is supposed to check the venomous tendencies of the remaining poison and to prevent the development of bloodpoisoning.

Horses and cattle are not known to be fatally affected by snake venom. Their bulk is probably too great for the amount of poison introduced into the system. Hogs are immune to snake bites, possibly because of

their tough hides and underlying fatty tissues with few veins. Hogs will kill snakes and then will eat them. But what will a hog not eat, even to its own young pigs? And Indians seem to be strangely immune. But the Indians are mightily afraid of the rattlers just the same. In the annual ceremonial of the snake dance among the Moquis the dancers actually hold rattlers in their mouths and hands. Frequently they get bitten. But always after the dance the participants partake freely of a peculiar herb soup or concoction made by their medicine man. It is a violent emetic. What it is made of or why an emetic should be effective are not yet known to science. A. R.

The Accuracy of Gas Meters

The New York state public service commission had 357,793 gas meters tested for accuracy of measurement of the gas flowing through them. The rule there is to have a test made wherever a consumer requests it; then if the meter be found running fast the company must bear the cost of the test and make good certain back excesses; but if the meter be found all right or actually running slow then the consumer must stand the expense of the test. Out of all that vast number of meters only 3,443 were found running fast. That is about one per cent., or one meter in every hundred. If more people understood the gas meter and its general accuracy they would look elsewhere for the cause of a big gas bill. Often it is carelessness in leaving gas burning when not needed, or in having old or wasteful burners.

C. E. Young, superintendent of the Marysville power division, is the father of a son born July 16th, which is also the father's birthday.

Arthur H. Burnett, superintendent of the company's South Tower power division, and Miss Alberta Bell of Paso de Robles were married at the bride's home the 27th of July. The wedding trip was to Catalina and the land of orange blossoms. The groom is a Stanford graduate of the early crop of 1895. He was a big guard on the varsity football team, answering to the nickname "Ox" Burnett. The new home is in Richmond.

Leo H. Susman of the company's law department and Miss Mildred Tonn of San Francisco are to be married some time in November and reside in San Francisco. The prospective groom is a Stanford graduate, with the class of 1901.

There are more than 7,000 beekeepers in the United States, and the honey crop last year was great enough to have filled a train of box cars four hundred miles long.

If handkerchiefs or wash clothing be scorched in ironing the scorch marks will permenantly disappear soon after the cloth is exposed in bright sunshine.

A new concrete substation has just been completed for the company's use at Livermore. The building is twenty-five by twenty-seven feet on the ground and is twenty feet high. It is to contain four 200-kilowatt transformers for reducing the intensity of the current from the 60,000 volts at which it is carried on the main power-line.

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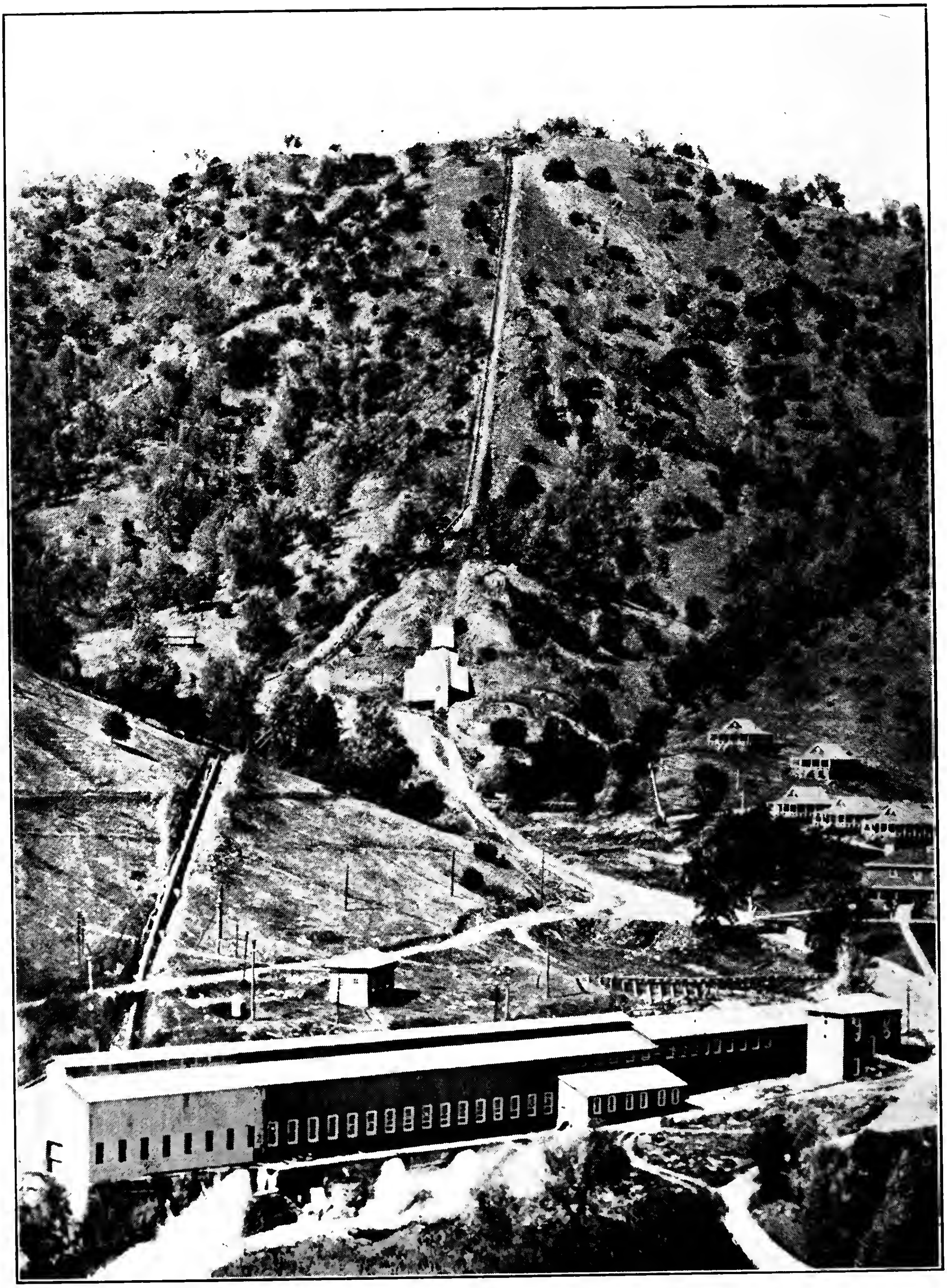


GENERAL VIEW OF THE ELECTRA POWER PLANT ON THE MOKELUMNE RIVER IN AMADOR COUNTY, CALIFORNIA, WHERE 26,666 ELECTRICAL HORSEPOWER IS GENERATED

PACIFIC GAS AND ELECTRIC MAGAZINE

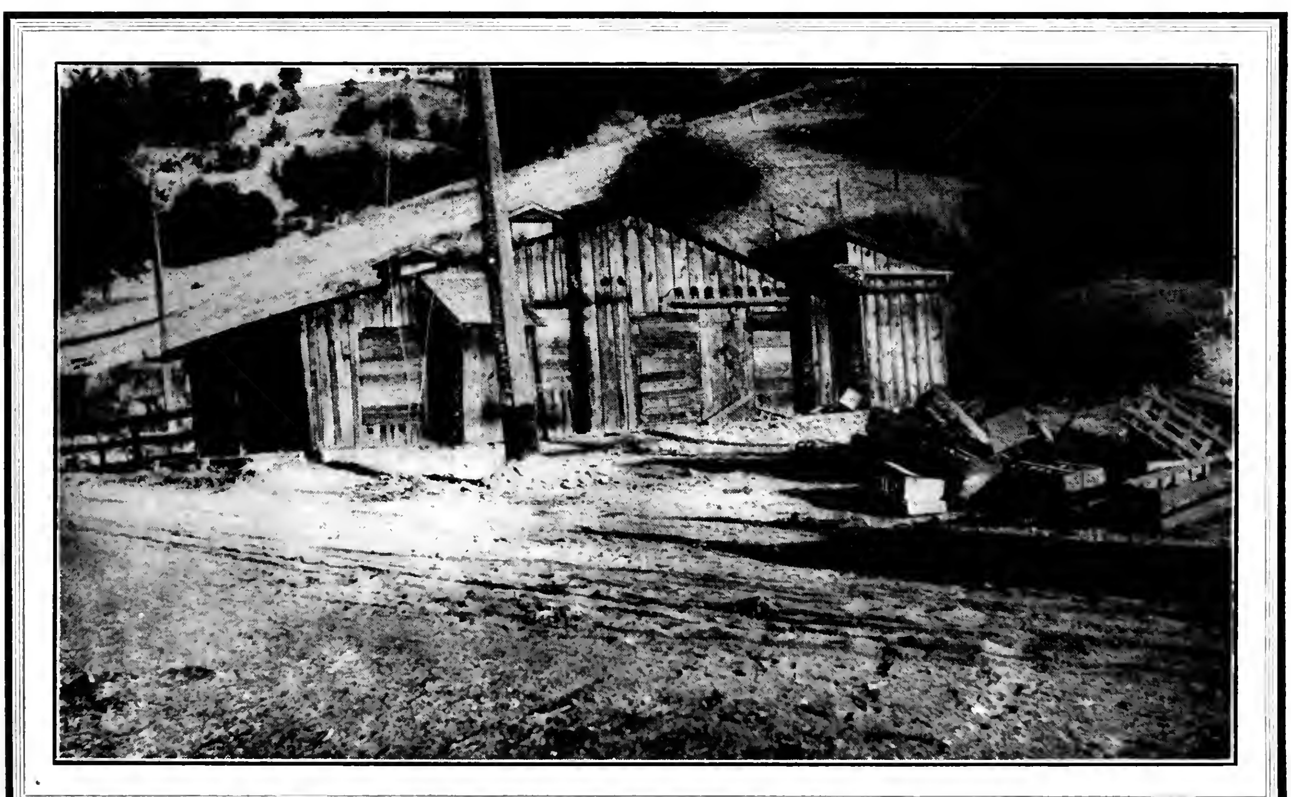
VOL. II SEPTEMBER, 1910 No. 4

The Great Power Plant at Electra

By ARCHIE RICE

Archie Rice

In California snow is converted into electric light. The dazzling white mantle upon her lofty mountain tops flashes forth again in another form down in the distant cities by the sea. California sunshine sips vapor from the heaving bosom of the Pacific. The trade winds carry the saturated atmosphere inland. Heated air rising from the great interior valleys buoys up the vapory masses as they pass way overhead. They float gently on till they are checked by the towering ramparts of the mighty divide that walls California all along her eastern boundary. Hovering there the clouds wait till a fall in the temperature relieves them of their burden. To the deep, white masses upon the Sierra crests those clouds then add their myriad of little icy crystals.

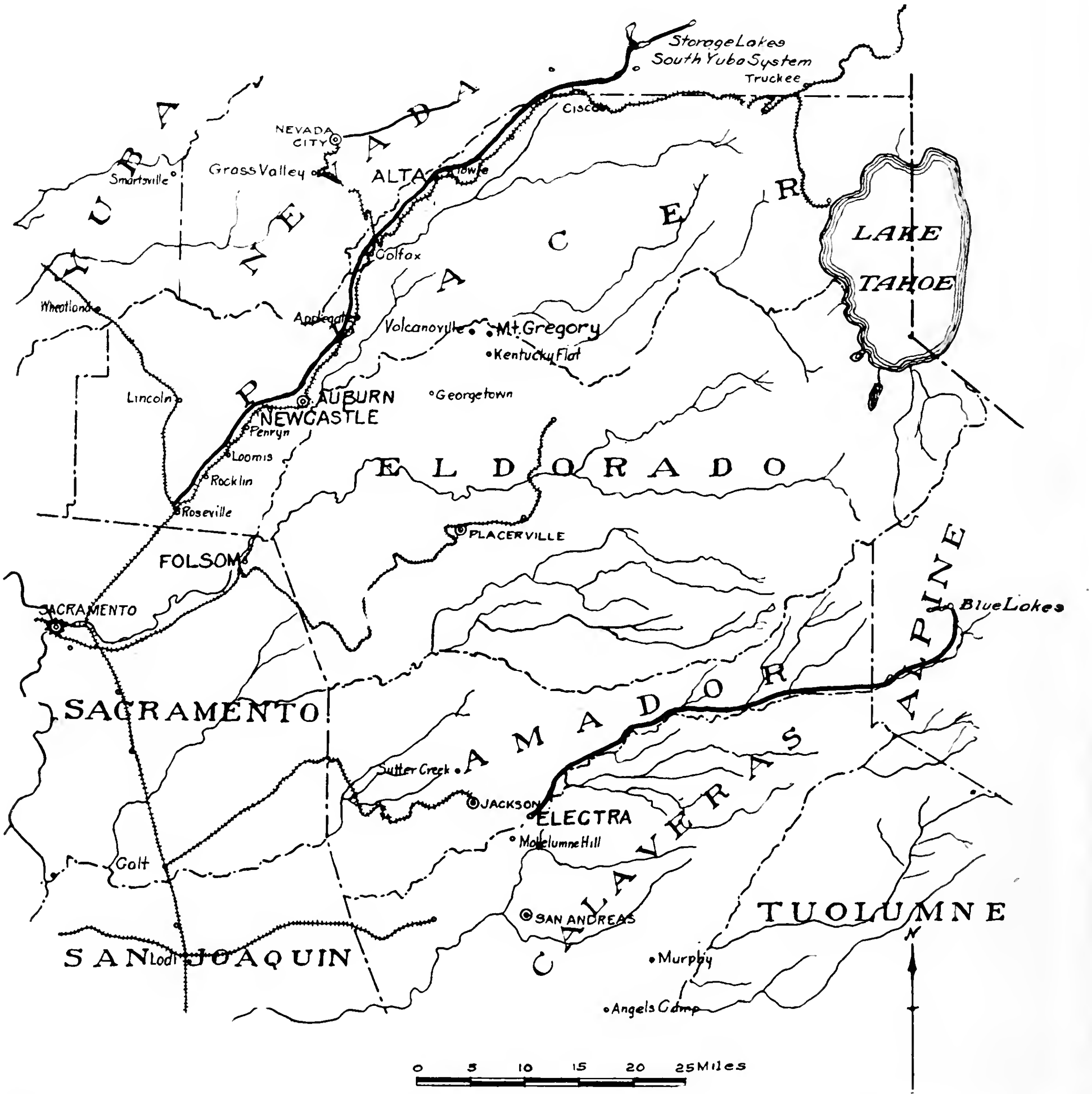


The original Electra Power Plant

Again California sunshine brings a change. The rainy season is over. Drying valleys are athirst. Steep mountain-slope streams are dwindling. And then that jagged white skyline begins to melt and renew the springs.

sparkle in the night like a fairyland strewn with brilliants.

You get the wonderful effect of it when gazing down from the summit of Mount Tamalpais, 2,600 feet above the Golden



Showing the Location of the Company's Alta, Auburn, Newcastle, Folsom, and Electra Power Plants and their water sources and canals

The gleam in that mountain-top snow, ten thousand feet in the air, starts on its way to be transformed into the glow of artificial light. After a downward journey of more than two hundred miles it appears again, spangling the darkness about San Francisco Bay with tens of thousands of lights, picking out the cities in detail and making them

Gate. The accumulated energy that makes these city lights has come from snowy summits four times as high as Tamalpais.

No other hydro-electric power system in the world more graphically demonstrates the various stages of this mysterious evolution of a snowball into an incandescent light than does the giant generating plant at Electra.

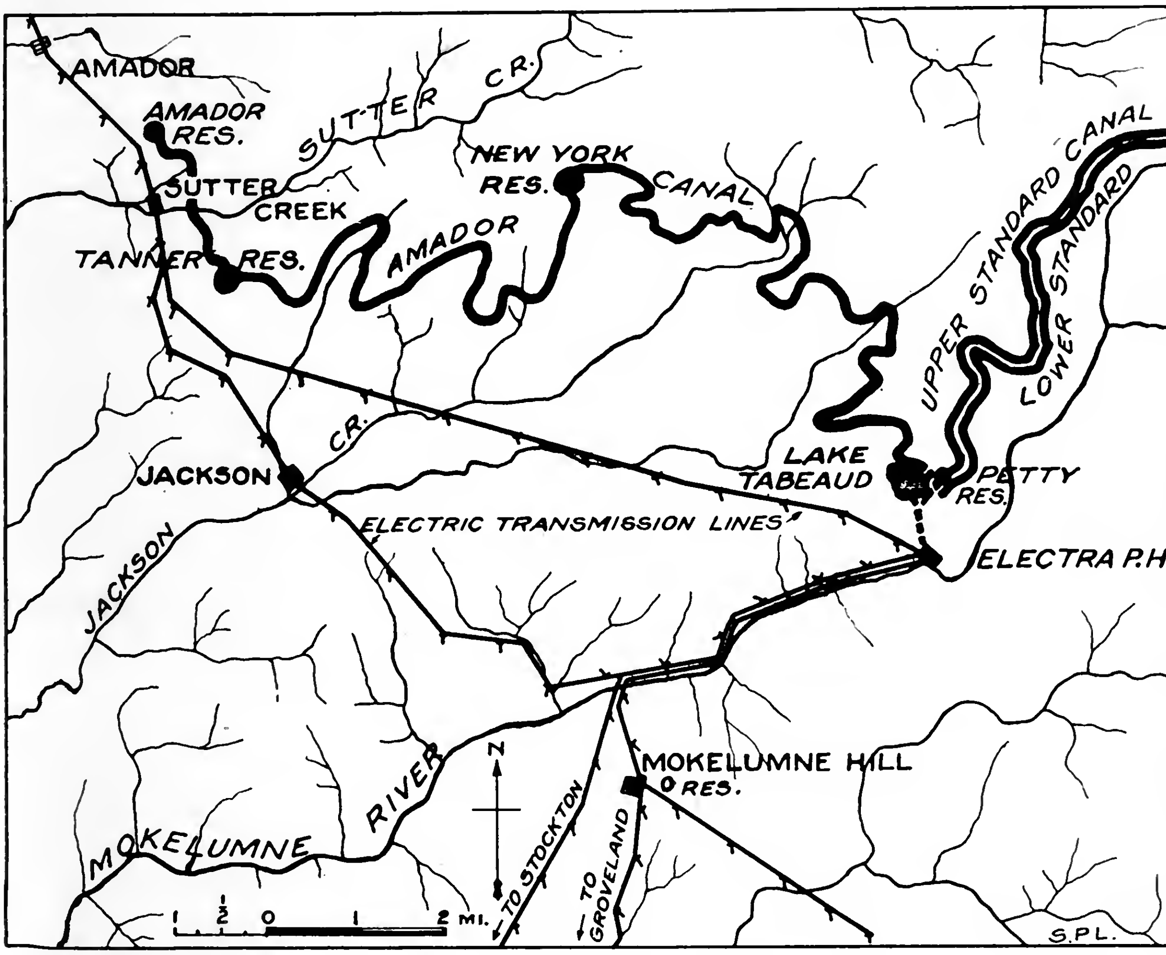
It is on the Mokelumne River in Amador County, near the middle of the eastern part of California, a dozen miles from the old mining town of Jackson.

A little to the southward of Lake Tahoe is Alpine County. It is so sparsely peopled that, all told, its inhabitants would form a village of only a few hundred people, and mostly Indians at that.

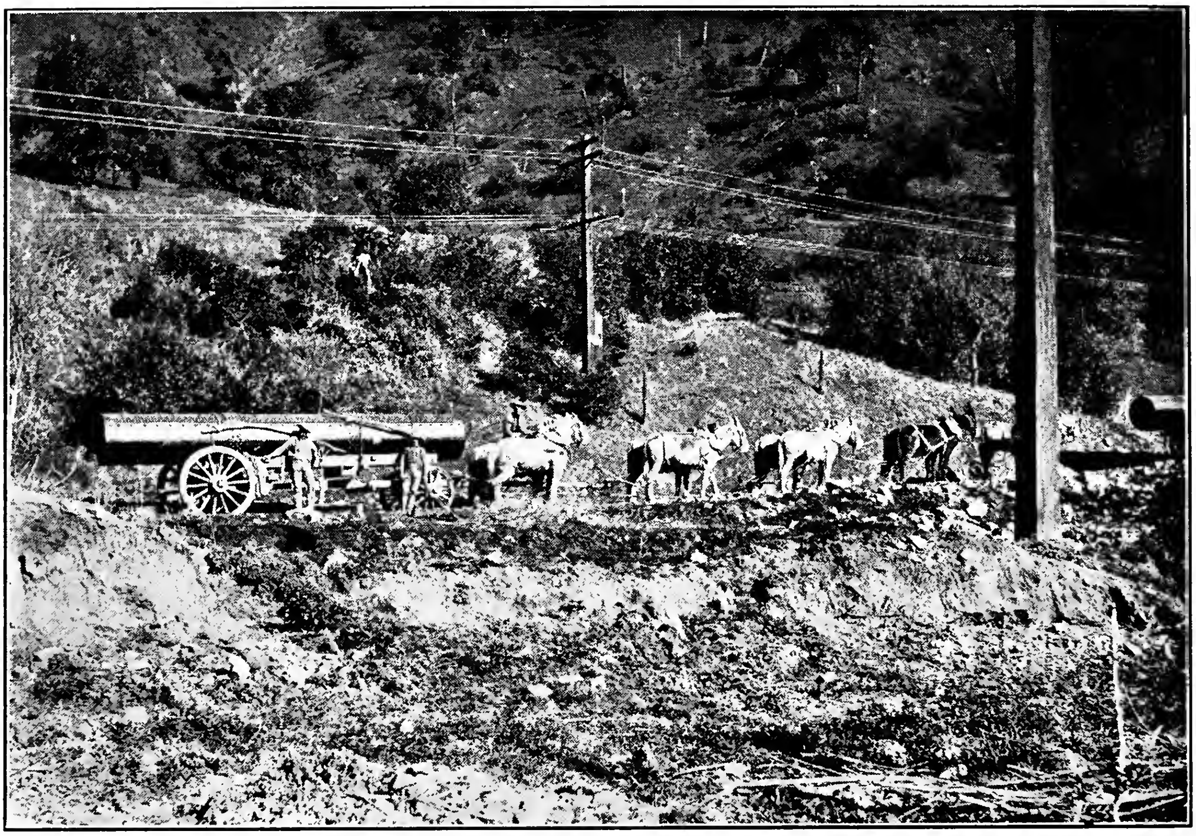
Alpine County is rightly named. Its back is humped and its sides slope east and west from the divide. Terraced high along its western slopes are natural basins filled with snow-water.

That is the country of the Blue Lakes. And the Blue Lakes are part of the high, mountain, storage system that supplies the Electra power plant. There are four lakes in that group. They cover an area of from one hundred and twenty to three hundred and forty acres each. They range in depth from twenty to sixty feet and in elevation above the sea-level from 5,700 to nearly 8,200 feet. They store water for the day of need.

Men stationed at the lakes regulate the outflow into the Mokelumne River according to telephonic directions given them each day by the superintendent at the power plant. He calls for whatever water-flow he needs, and he gets it. The lakes are eighty miles from the power plant. The river for some fifty miles serves as a channel outlet for the lakes. Then ditches and canals tap the river and skirt the mountain ridges and bring the lake water gradually along for twenty miles to the place where it is finally shot down through big steel pipes to drive the impulse wheels at Electra. In those twenty miles the river drops about sixteen hundred feet. But



Map showing the immediate surroundings of the Electra Power Plant



Ten-mule teams hauling in sections of No. 3 pipe-line

the man-made canal uses a very gentle gradient. When the canal water finally reaches the forebay reservoir on a ridge overlooking the river, it is then more than 1,450 feet higher than the river water flowing past the power house that stands down below on the bank of the Mokelumne. In falling from that height the diverted water produces unbelievable energy, tremendous power. It flows down through the pipes at a steep angle. The height of the fall produces an amazing hydraulic force. From the four-inch nozzles under the power house the liberated jets flare big and shoot two hundred yards out into space, driving furiously at a speed of three and four-tenths miles a minute.

They have torn up the rock-ribbed river-bed as the stream from a garden hose might gutter out soft loam. When they emerge from the building they are already swollen to the thickness of a man's body. They flare bigger as they slip through the air—rocketing, hissing, moaning, humming, thundering with a force that fascinates the spectator.

The lofty drop is the favorite California method of producing water-power. In the east they slightly divert a river to make a fall of a few feet, relying on a great volume of water to create the force. But the steep slope of the streams in the Sierras and the convenient chances for reserve storage permit the use of much less water and the creation of an artificial fall of many hundreds of feet to produce enormous power.

That battering force at Electra strikes into the steel water-wheel buckets like a hurricane into a windmill and revolves them faster than the eye can follow the movement. The ponderous shafts connected to these water wheels turn the seven huge electric generators.

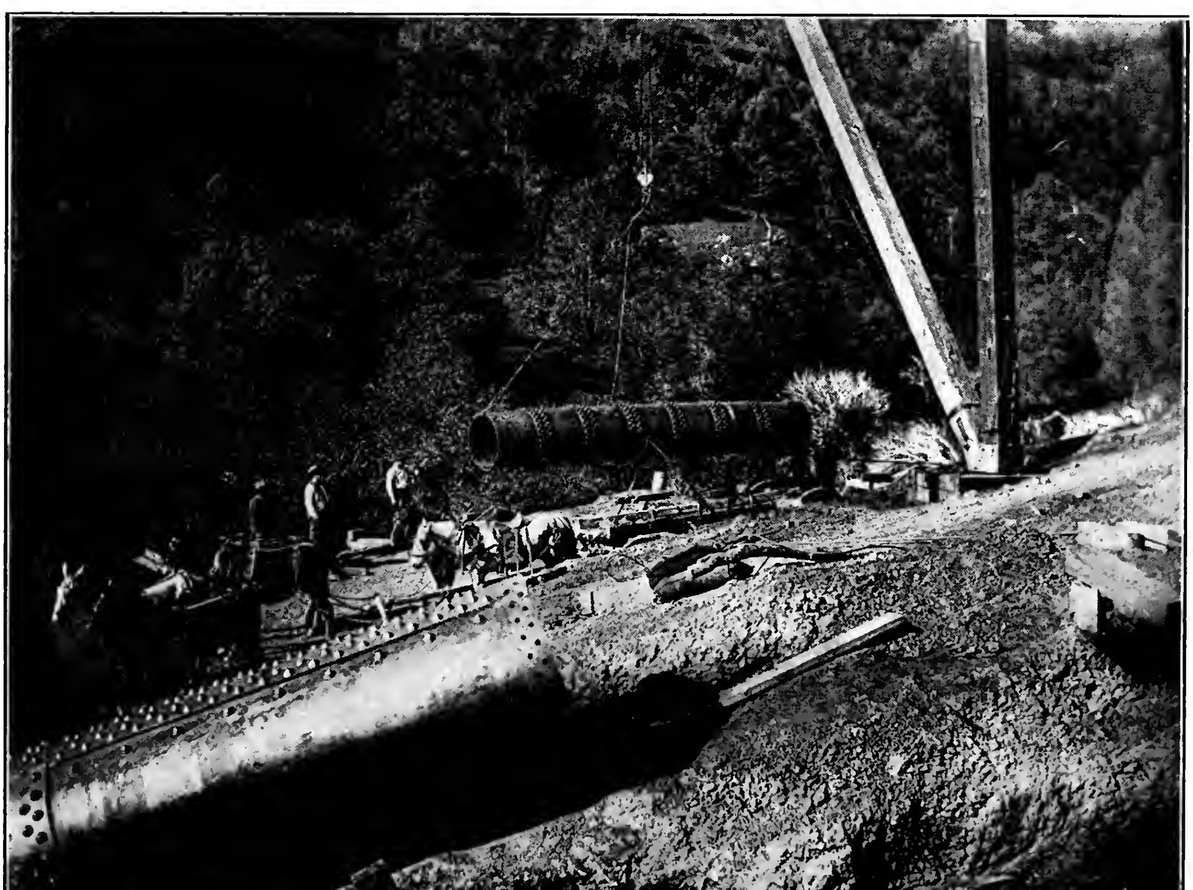
Thus the snowflake becomes the electric spark.

The collected energy stored up in these mountain lakes has come down with a final rush to the power plant and been suddenly converted into a continuous force of 28,100 horsepower. Can you imagine the horse equivalent of that power? that many animals pulling at some great load? Close-coupled and hitched two abreast, the team would stretch out nearly twenty-seven miles!

Produced at a potential of 2,300 volts, that gigantic electric force is passed through eighteen transformers and its intensity increased to 60,000 volts. And at that force it thrills silently and unseen through big copper wire, over hills and across streams, traversing valleys and spanning channels along a pole-line route that runs through Stockton and Mission San Jose, and then diverges with a branch up to Oakland, another round the Palo Alto side of the bay to San Francisco, and a third to the seacoast in Santa Cruz County, a maximum transmission distance of one hundred and forty miles.

In this year 1910 the power plant at Electra holds first position in the electric world as the greatest producing station operated by mountain water-power. Other plants may have a bigger capacity in prospect, or on paper, but Electra is generating 28,100 horsepower. She sends her product to the comparatively nearby mines along the mother lode, transmits it down through the agricultural districts where it is used to operate great pumps in the reclamation of delta lands, delivers it to various big manufacturing industries, and to thousands of homes in a score of cities.

Electra as a power plant was an evolution from a different purpose. Back in the year 1871 the Blue Lakes Water Company was



Swinging sections of No. 3 pipe-line from a ten-mule wagon into place with a derrick

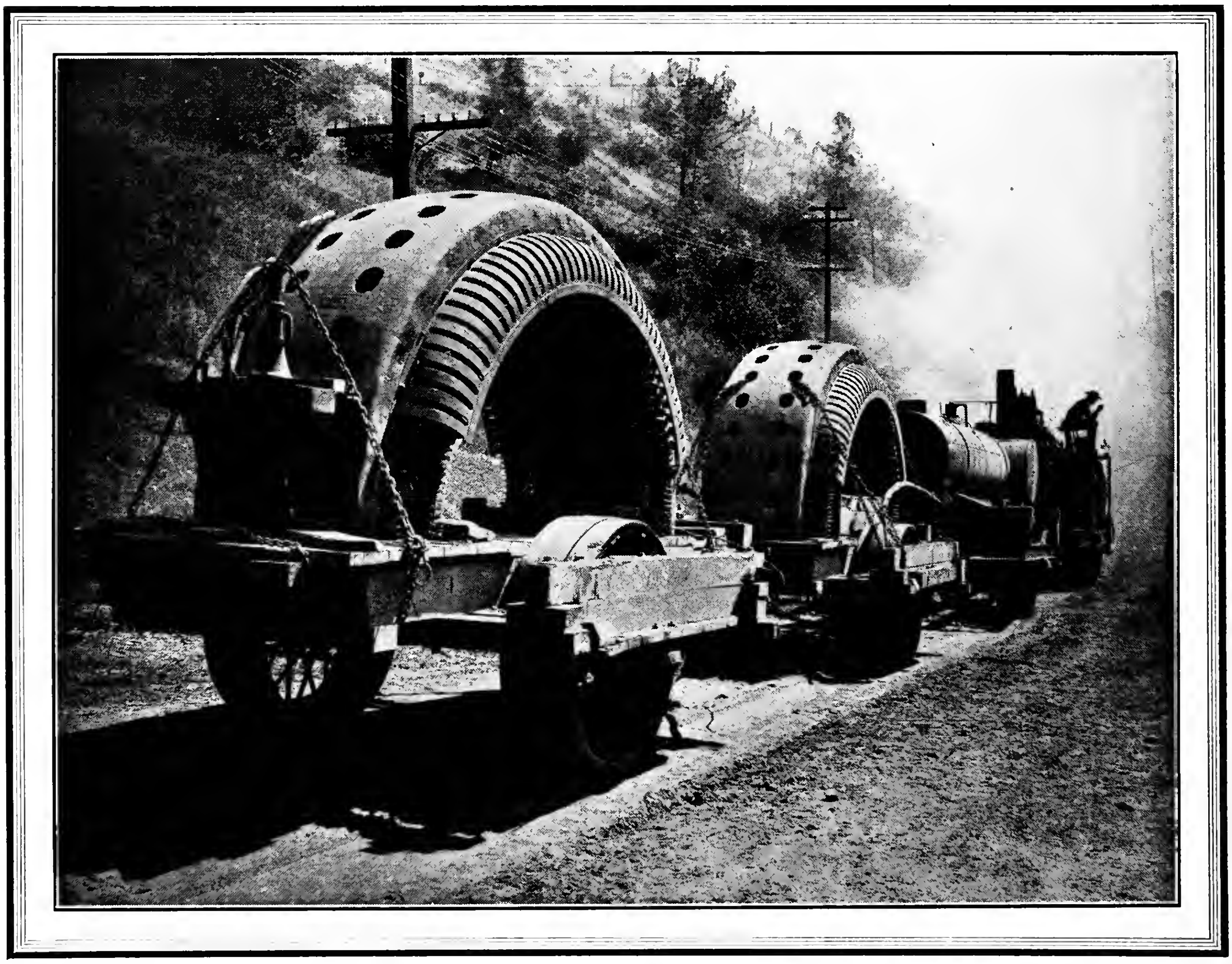
formed to supply water to the gold mines in Amador County. A ditch system more than eighty miles in length was built to convey the lake water to where it could be sold to the miners. For nearly thirty years the enterprise was very profitable. Then hydraulic mining was forbidden by law because of the muddy debris that was choking up the navigable streams. And old producing quartz mines began to wane. The water company's business accordingly dwindled. There was lack of consumers.

Along in the nineties there came to California a tall, rather esthetic-looking young man who was welcomed in the highest society. He was the proud descendant of a royal Polish family that had maintained its titles despite the expatriating influence of Russia's grip on Poland.

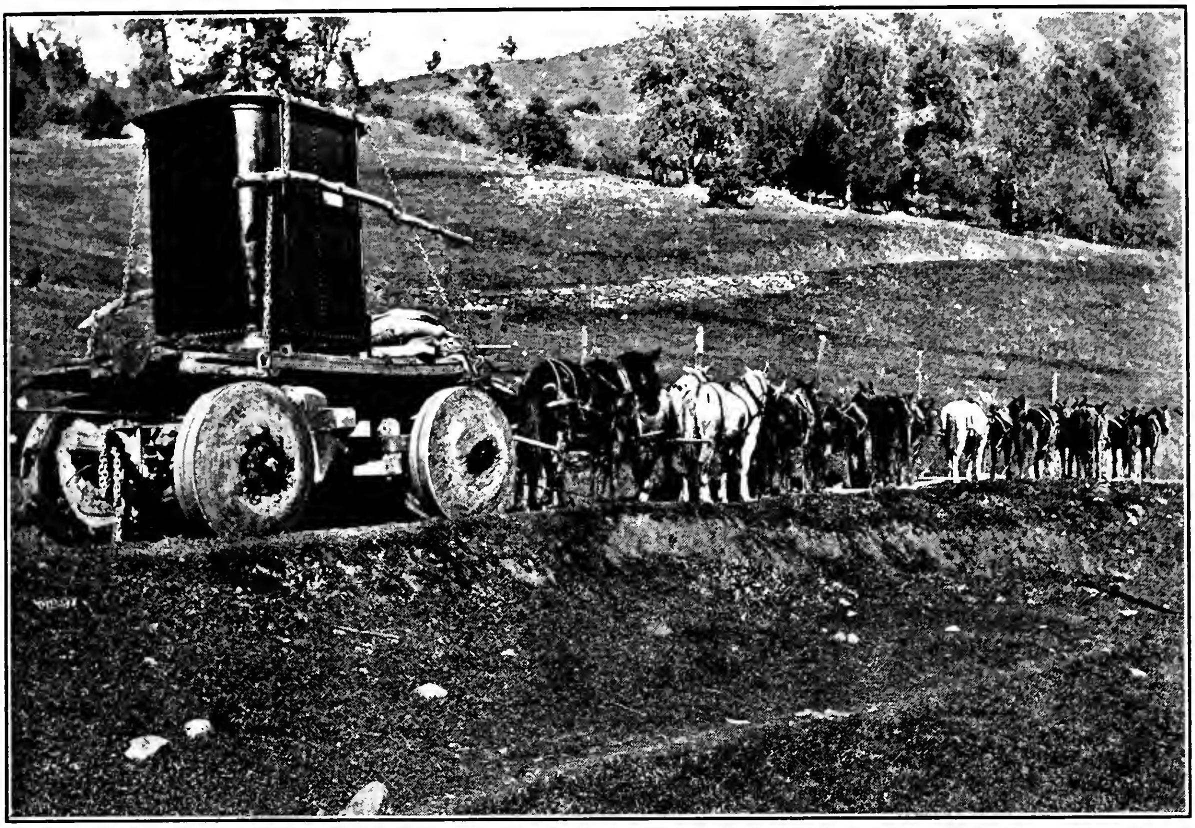
Prince Andrea Poniatowski cared for other things than social functions. He had the business instinct of the promoter and a personality that could interest investors in his schemes.

He conceived the idea of buying up a lot of those old abandoned mines in Amador County and consolidating them under a single management that they might be worked for a profit. And while he was studying out the situation he hit upon another idea. Why not take water from that Blue Lakes Water Company's ditch and drop it down at a convenient point and use the fall for a hydro-electric plant?

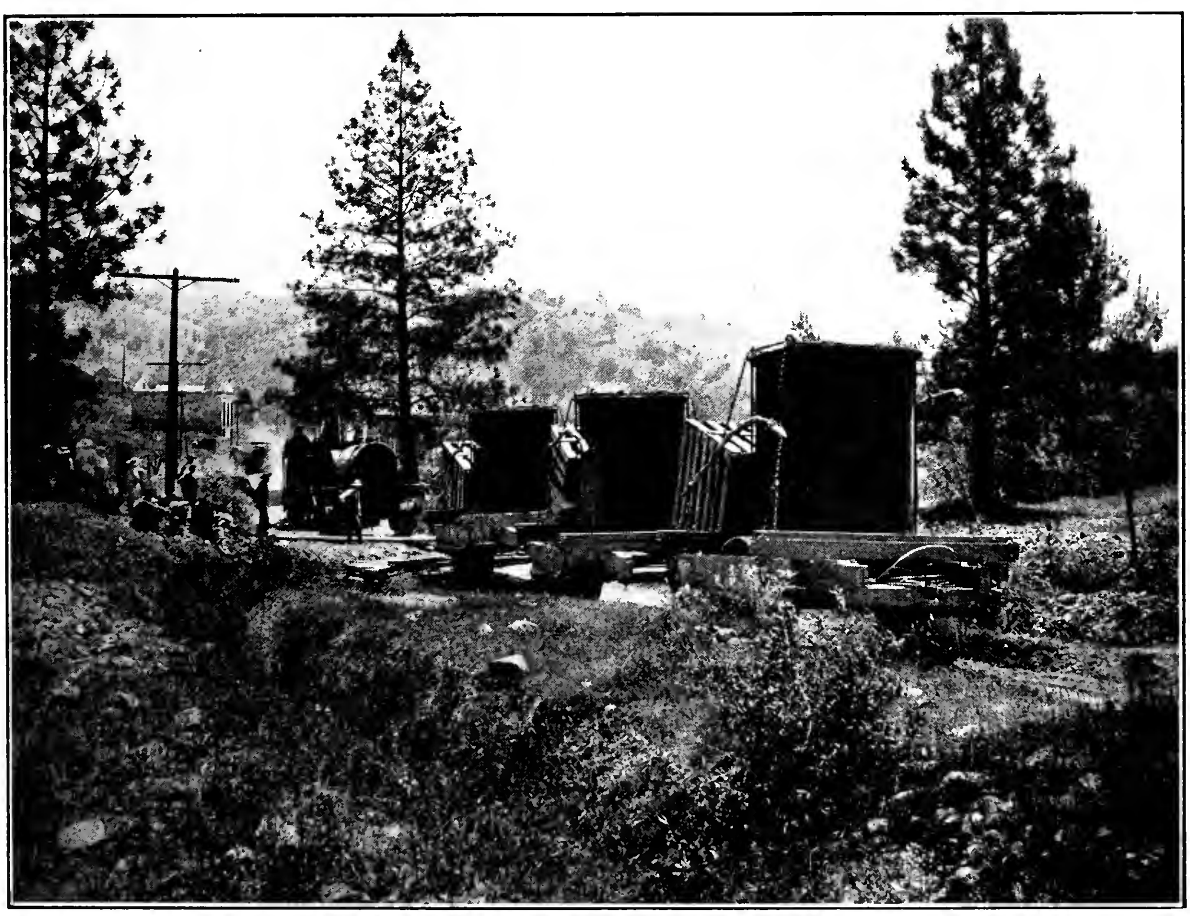
So he started the original Electra power house. It was located on the Mokelumne River about three miles downstream from the present plant. It got its water from a ditch



Traction engine hauling armatures for the 5,500-kilowatt generators



An eighteen-horse team hauling in one of the 1,250 kilowatt transformers



A traction engine hauling three of the 1,250-kilowatt transformers between Jackson and the Electra power plant

The shaft of one of the 5,500-kilowatt generators being hauled near the Electra power house, with horses and by cable

flowing along the ridge at an elevation of about a thousand feet above the power house. It was his original intention to wire this electric energy to his mines and reduce the cost of their operation.

But before that little plant was completed Poniatowski had got still another idea. Why not buy out the whole Blue Lakes Water Company in its condition of business decline and build a big power plant and transmit electric energy way down to San Francisco, a distance of one hundred and ten miles? There was no precedent at that time for any such long-distance transmission. His was a daring plan. But he interested investors, bought the water company, and formed the Standard Electric Company of California.

The best engineering skill in the whole country was sought for advice and plans. Nothing was adopted that was not feasible. Practical ideas were everywhere incorporated into the scheme. After the company's own engineers had figured out the possibilities and the costs the Stanley Electric Manufacturing Company of Pittsfield, Massachusetts, proposed the then amazing plan of operating the power lines at 50,000 volts, and promised such a monetary saving that the contract was awarded to that company for the machinery.

So careful were the builders of the big plant in making sure that their ideas were feasible, that the energy could be transmitted more than one hundred miles when the arrangements should all be completed, that

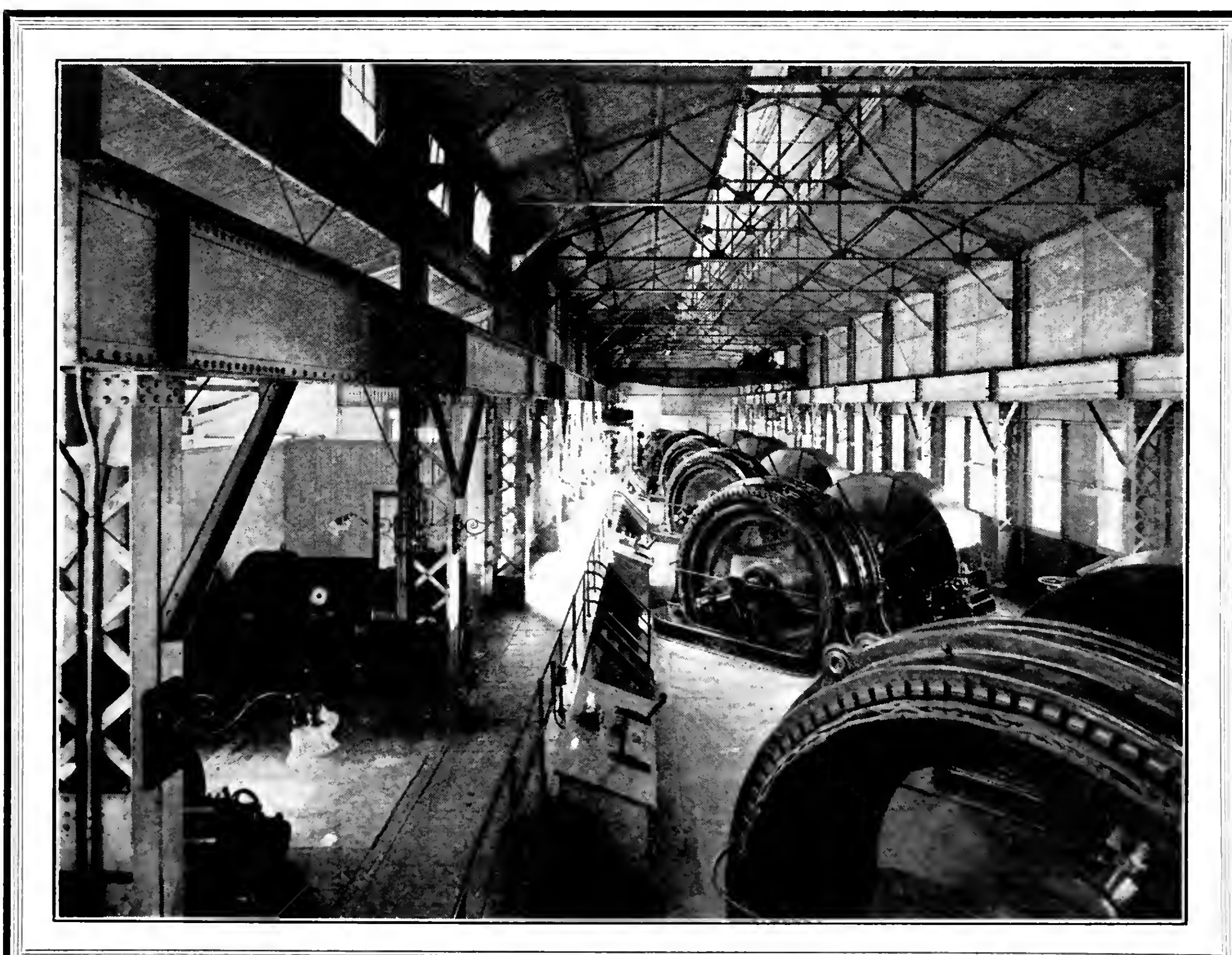
they took four years for the work. Every step was a certain one. So sure were they of successful accomplishment that they contracted to furnish certain power to certain prospective consumers on a certain date.

While the builders of Electra were taking time and infinite precautions to guard against failure the big Colgate power plant was started and built in a hurry by John Martin and Eugene de Sabla. They mapped out a power-line headed for Oakland and did the amazing thing of spanning the Straits of Carquinez with aerial cables more than two hundred feet above the water and some 6,000 feet long. Thus Colgate beat Electra to the honor of being the first California mountain power plant to send its energy down into the cities about the bay; achieved even a greater transmission distance than Poniatowski had planned for Electra.

At first the intention was to bring the Electra power lines down through Stockton to the bay, and then across to San Francisco on poles driven in the shallower water far to the southward of the ferry crossings. But the United States government would not consent to the planting of poles across the bay. So the line was led through the hills to Mission San Jose and forked there up both sides of the bay by land.

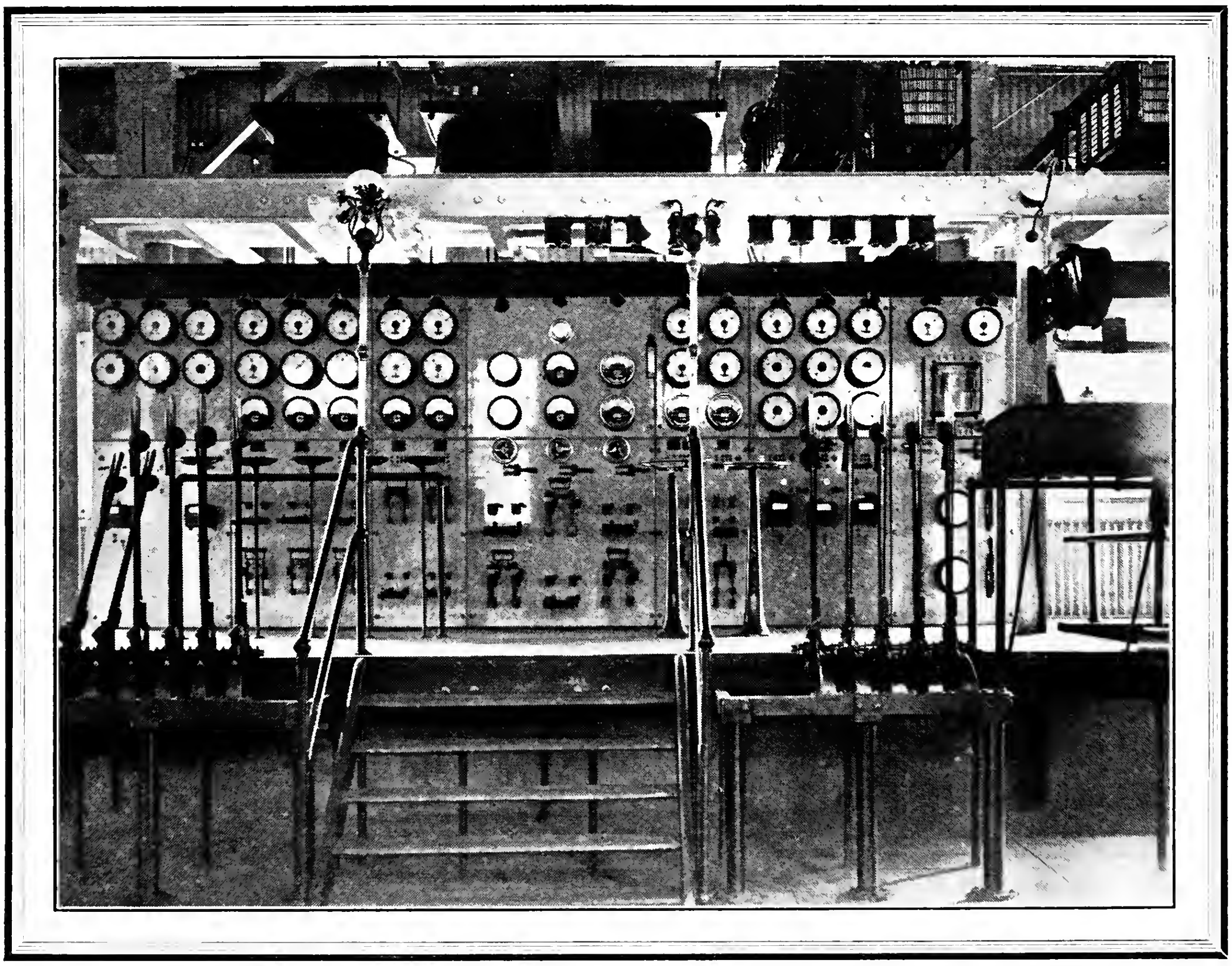
It was estimated that the storage capacity of the Blue Lakes and the associated reservoirs owned by the company in the high Sierras would keep the Electra plant running for a period of one hundred and fifty days if necessary. And that was time enough to carry it through the longest dry season ever known in California's history.

A great force of workmen was sent into the mountains to repair and enlarge the aque-



In the power house at Electra

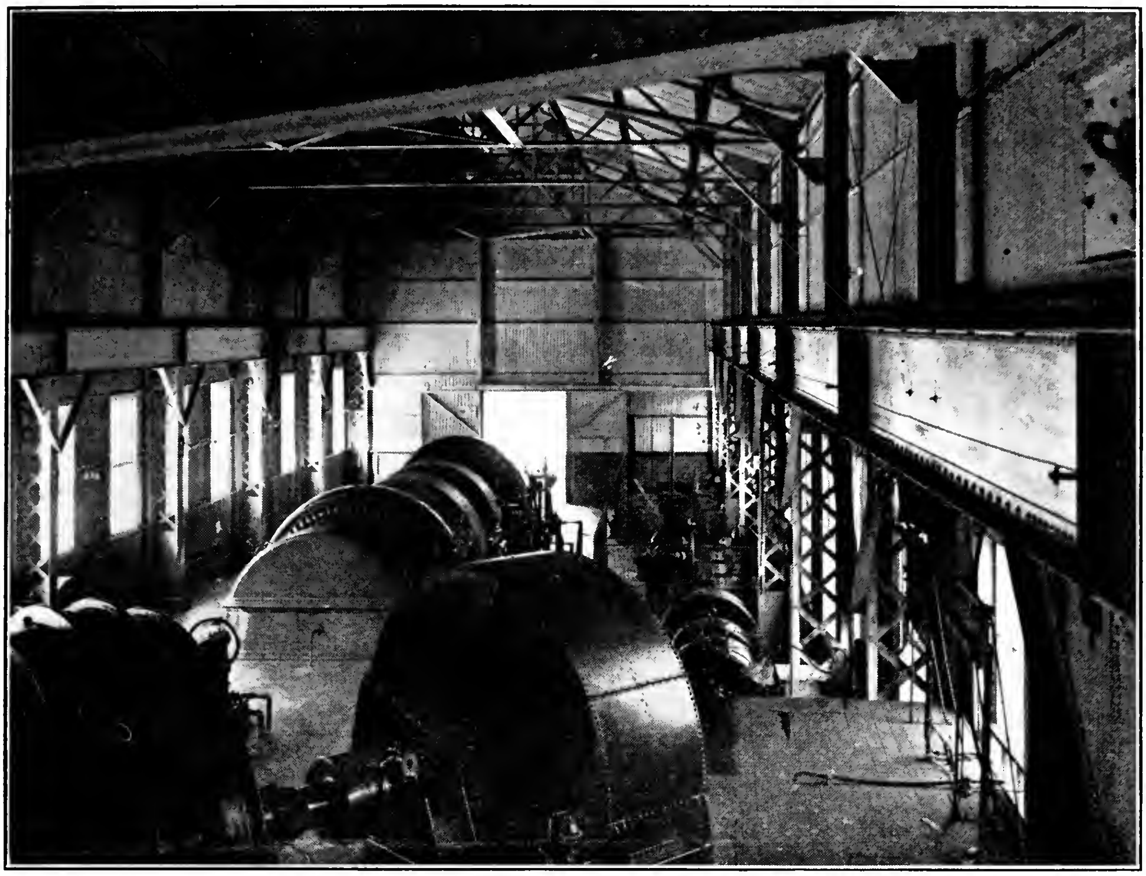
ducts and carve the way for the big plant. There were four construction camps with from one hundred to three hundred men in each. Those were great times in 1901 for the contractors! They exploited the workmen for their own gain. Each camp had its saloons and its gambling outfit. Men were paid in cash, and they were encouraged to should have a chance up there in the mountains to save some of the money that they earned; that many purposely sought employment far from towns that they might avoid drink and save their earnings. And from that day on the contractors had to forego the exploitation of the workmen as a side profit.



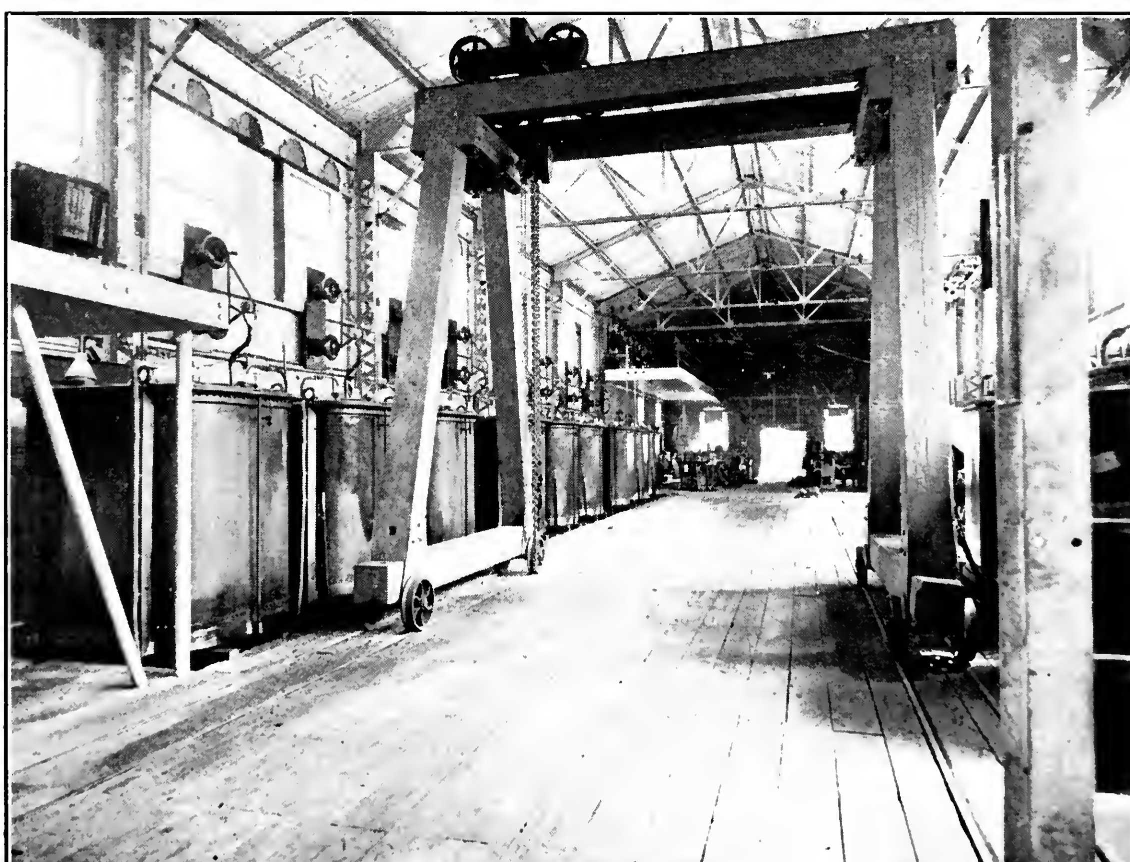
The Switchboard in the Electra Power House

spend freely at the camp. Those that did not patronize the bar were considered undesirables and eliminated. This sort of thing went on till J. Frank Pierce happened to go up into the mountains. He is a prominent Mason, well known throughout California. He was one of the officials of the Standard Company. He had the liquor at every camp dumped out. He made them throw away the crude kitchen ware. He installed a new order of things. He announced that men

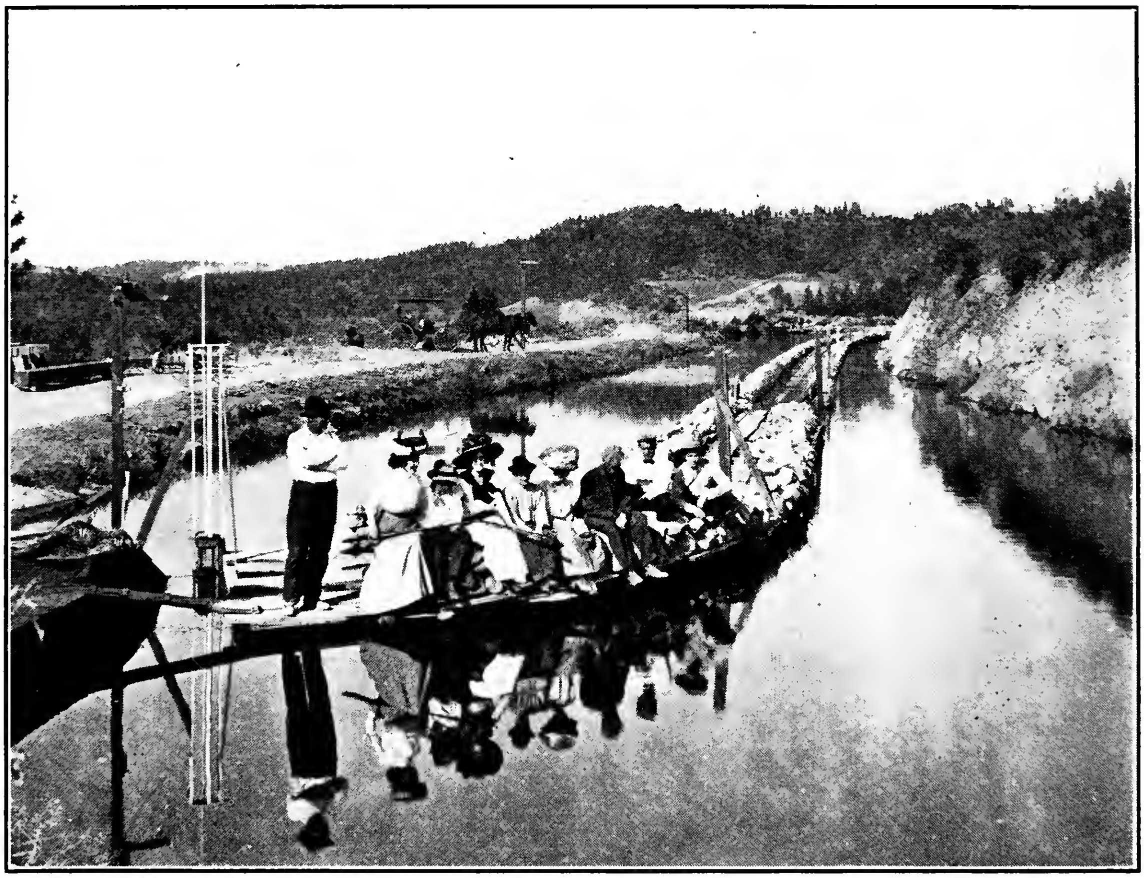
Twenty miles upstream from the Electra power house there is a concrete dam across the Mokelumne River. There a flow of 5,000 miner's inches is diverted into the Standard ditch, which is built along the mountain side to a point opposite the power house. This ditch empties into the petty reservoir, which is the forebay from which the three original pressure pipes carry water down to the plant, a pipe-line distance of about 3,600 feet. This is the source of the high-head



The west end of the Electra Power House, showing the two 5,500 kilowatt generators of the later installation and one of the five (diagonally set) 2,000 kilowatt generators of the original installation



Showing the transformers and the machine shop in the east end of the power house



The Petty Reservoir, Electra, from the lower end, at the ditch-tender's cabin

On the extreme left (standing) is the ditch-tender; on the extreme right is Alex. Moran, operator at Electra; second man from Moran is Archie Rice; the other men are employed in the power house at Electra; the first woman on the left is Mrs. Gallagher, wife of one of the employees at Electra.

that operates the five original generators of 2,000 kilowatts each.

The petty reservoir is a long, narrow gash partly behind the crest of the ridge and covering an area of about two or three acres to a depth of six or eight feet. From near the inlet end of this little reservoir a flume branches westward carrying the water to the mines in Amador City, Jackson, and Sutter Creek. Along that ditch system are three minor storage reservoirs holding 4,640,000 cubic feet to maintain the supply to the towns.

When the demand for electric energy grew beyond the original expectations of the California promoters of power plants Electra prepared to enlarge its generating capacity.

A second canal, called the Amador ditch, was built, taking water out of the river at a point about two miles below the first one. This canal practically parallels the course of the earlier adequct, winding along below it on the mountain side. With this additional flow it was intended to operate two new generators each of 5,500 kilowatt capacity. These machines, really smaller and more compact than any one of the old ones generating only 2,000 kilowatts, were installed in a comparatively small addition built onto the southern end of the power house.

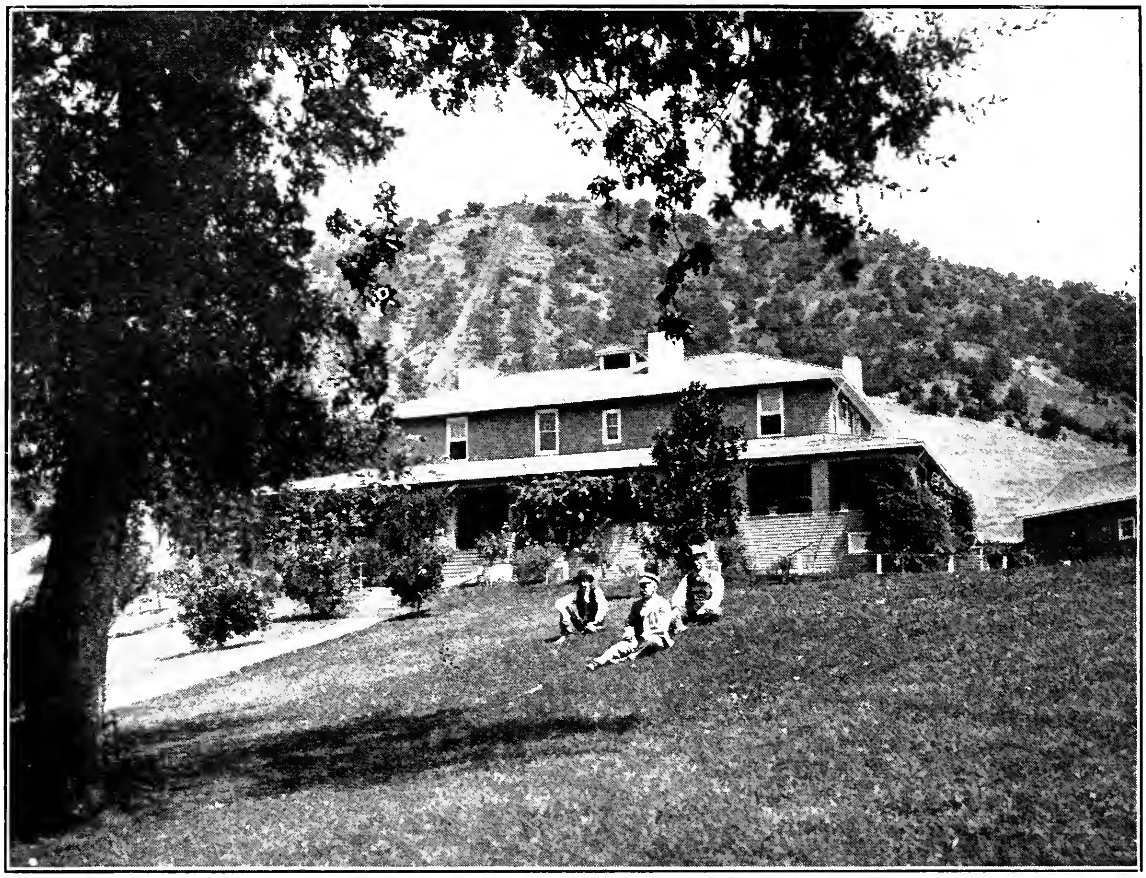
The frontispiece picture shows the Electra power plant at a time before the new addition was painted. It is interesting because in that small section more energy is generated by the two machines than in all the rest of the building, with its five bigger machines of an older type.

The original machines were set diagonally across the power house floor to have them more nearly at right-angles to the direction of the water flow in the pressure pipes. But when the two new generators were installed by Frank G. Baum they were placed square with the building and the end of the new pressure pipe was curved to produce a final right-angular strike of water into the buckets.

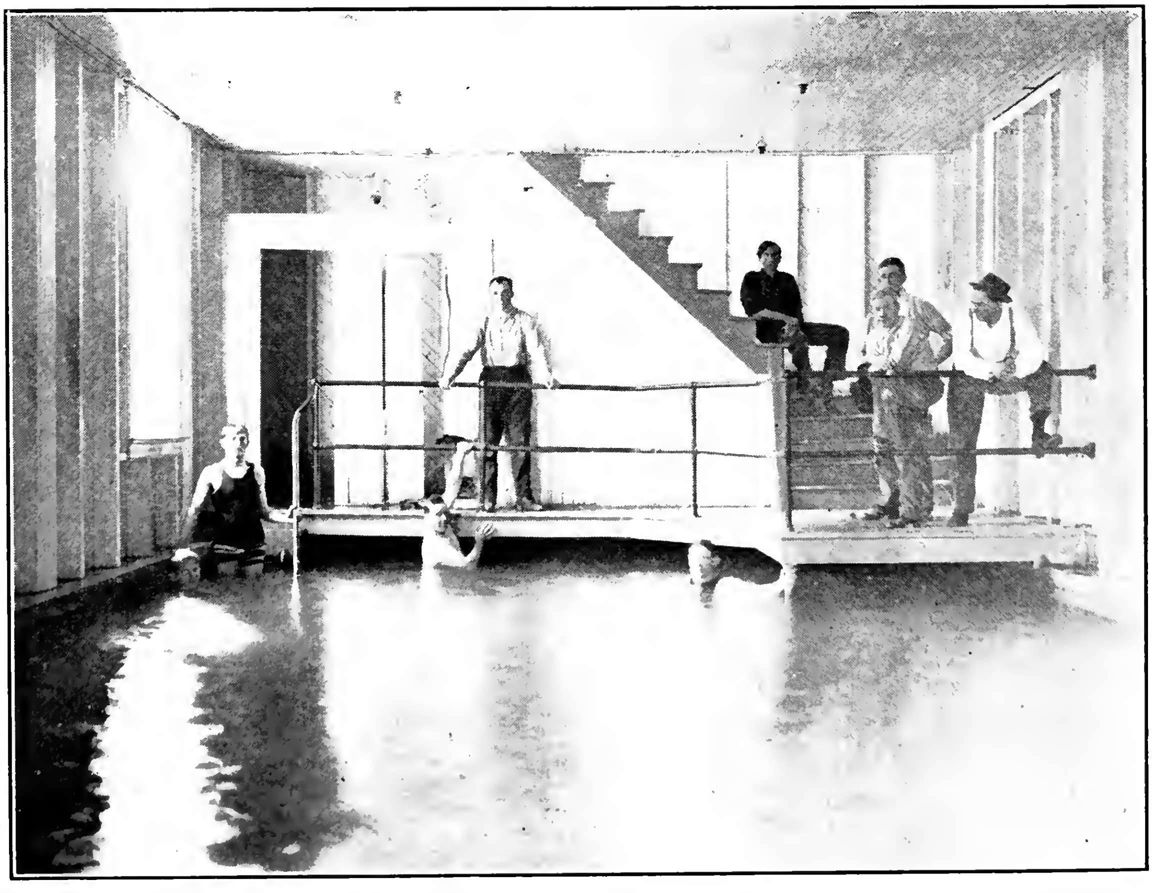
The lower canal produced a fall of about 1,250 feet. But there was no way of checking the flow of water or conserving it when it was not needed on the wheels. Nor was there any space on the river side of the mountain where a small storage reservoir could be excavated to receive the surplus flow. There was no way of controlling the flow in either ditch along that twenty-mile route.

A novel engineering plan was then perfected. On the opposite side of the ridge, where descending lateral ridges left a wide ravine, a high earth-fill dam was built and a reservoir created that is known as Lake Tabeaud after the Tabeaud family that had owned the land. This lake has a surface area of about forty acres. It is fed by the excess flow spilling over from the petty reservoir two hundred feet above it and also by the excess flow from the lower canal. But the unique feature of the scheme is that a tunnel 3,000 feet long had to be dug through the ridge to make an outlet. Through this long tunnel the water from Lake Tabeaud is drawn off into the low-head pressure pipe. At the outflow mouth of the tunnel there are gates in two of the descending high-head pressure system pipes. Thus water from

Lake Tabeaud, over the ridge above Electra, showing the high earth-fill dam



The Clubhouse, known as the Standard Hotel, with John A. Britton and friends on the lawn



The Swimming Tank at Electra

In the water are Will T. Jones, Weldy S. Yeager, A. S. Steinhart, Robert C. Trudgen; and on the the platform are Alex. Moran, L. H. Chiapetto, W. W. Youman, Jack Moran, E. Hopper.

Tabeaud dam may be turned into them in an emergency. But for the time they operate under the low-head pressure. By this arrangement all the generators in the power house may be run with water from Lake Tabeaud, which has a capacity sufficient to supply the plant for several days, in case of trouble on the ditches from the river.

When the great consolidation of central California power plants was effected a few years ago the Standard Electric Company, with its allied water company, became a part of the Pacific Gas and Electric Company and the largest of its generating plants.

The illustrations that accompany this article leave little for verbal description. They tell their own story of the scenery and surroundings.

Only no picture correctly conveys an idea of the steepness of the little tramway. You perch on a toboggan-like car and are quiveringly pulled 2,400 feet up to the top of the pressure pipe-lines, half the height of Tamalpais, in seven minutes.

Life at Electra is no miserable isolation. The environment is charming, the scenery inspiring; and ever, day and night, there is the unceasing hum of the generators converting that downrush of hidden waters into 28,100 electrical horsepower.

PHYSICAL DATA, ELECTRA POWER PLANT.

Capacity of storage reservoirs	1,079,902,616 cubic feet
Area of storage reservoirs	949.3 acres

Lake	Elevation-ft.	Flooded Area-Acres	Depth-ft.	Capacity-Cu. ft.
Twin	8,172	118.3	20	62,063,850
Upper Blue	8,131	343.5	27.5	293,859,766
Lower Blue	8,040	145	35	162,000,000
Meadow	7,773.5	141.2	65.5	244,500,000
Bear River	5,680	161.6	57.5	267,054,000
Tabeaud	1,965	39.7	90	50,425,000
Totals		949.3		1,079,902,616

Length of main ditch and flume system	36.75 miles
Flow the second in main ditch system	243 cubic feet
Elevation head — two pipes each	1,467 feet
Elevation head — one pipe	1,267 feet
Pressure of water the square inch — two pipes each	636 pounds
Pressure of water the square inch — one pipe	548 pounds
Speed of jets down at the power house	3.4 miles a minute
Number of impulse wheels	8
Capacity of generators	5 of 2,000 k. w. each; 2 of 5,500 k. w. each
Total electrical horsepower	28,100
Generating voltage	2,300
Voltage on main line	60,000
Altitude of petty, or forebay, reservoir	2,160 feet
Altitude at power house	693 feet
Size of power house	40 x 270 feet
Material of building	Concrete foundations, steel frame, galvanized iron covering
Plant placed in service	1902

New York state is first with 60,000 automobiles in service; and next comes California with 35,000, which is a surprising condition considering the comparative smallness of California's population. But the San Francisco fire suddenly showed the practical usefulness of the auto, and in the four years since then the number licensed has grown from 5,000 to 35,000! California's magnificent distances and her diversified scenery and many days of good driving weather are also responsible.

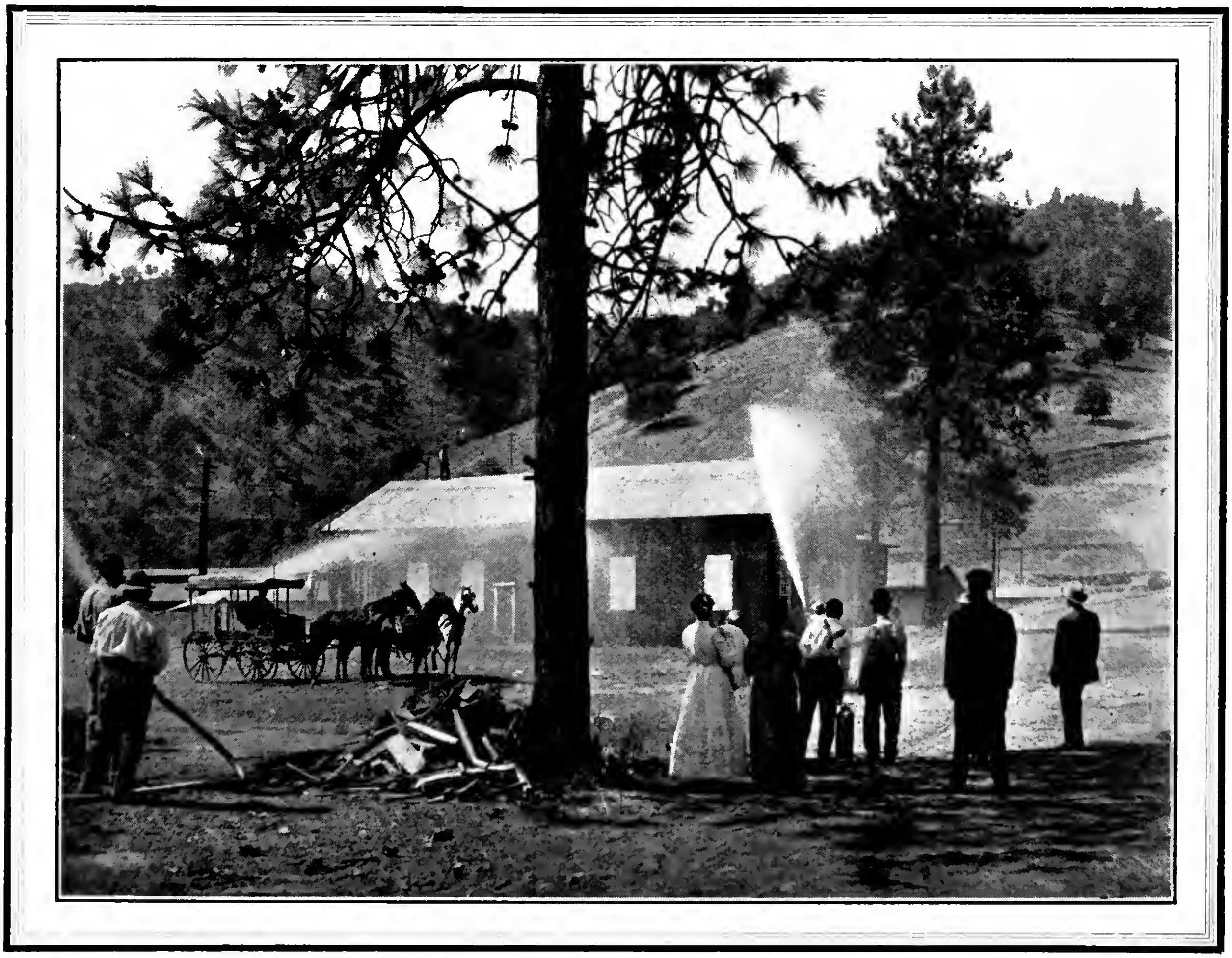
Fire Protection at the Electra Power Plant

By R. J. CANTRELL, Property Agent.

R. J. Cantrell

A bucket of water properly used at the inception of an ordinary fire has always been considered by the best fire-protection engineers as worth more than all the fire engines, chemical extinguishers, and other appliances that might be brought to bear at a later moment. Water does more good at the average fire than all other preventatives used by man in fighting his most dangerous enemy. Prehistoric man had many battles to wage for self-preservation. Modern man also has many contests, if not for self-preservation at least for his position and happiness in life.. Despite man's inherent and acquired intelligence his struggle with fire is always a fierce contest and one in which he is often most helpless.

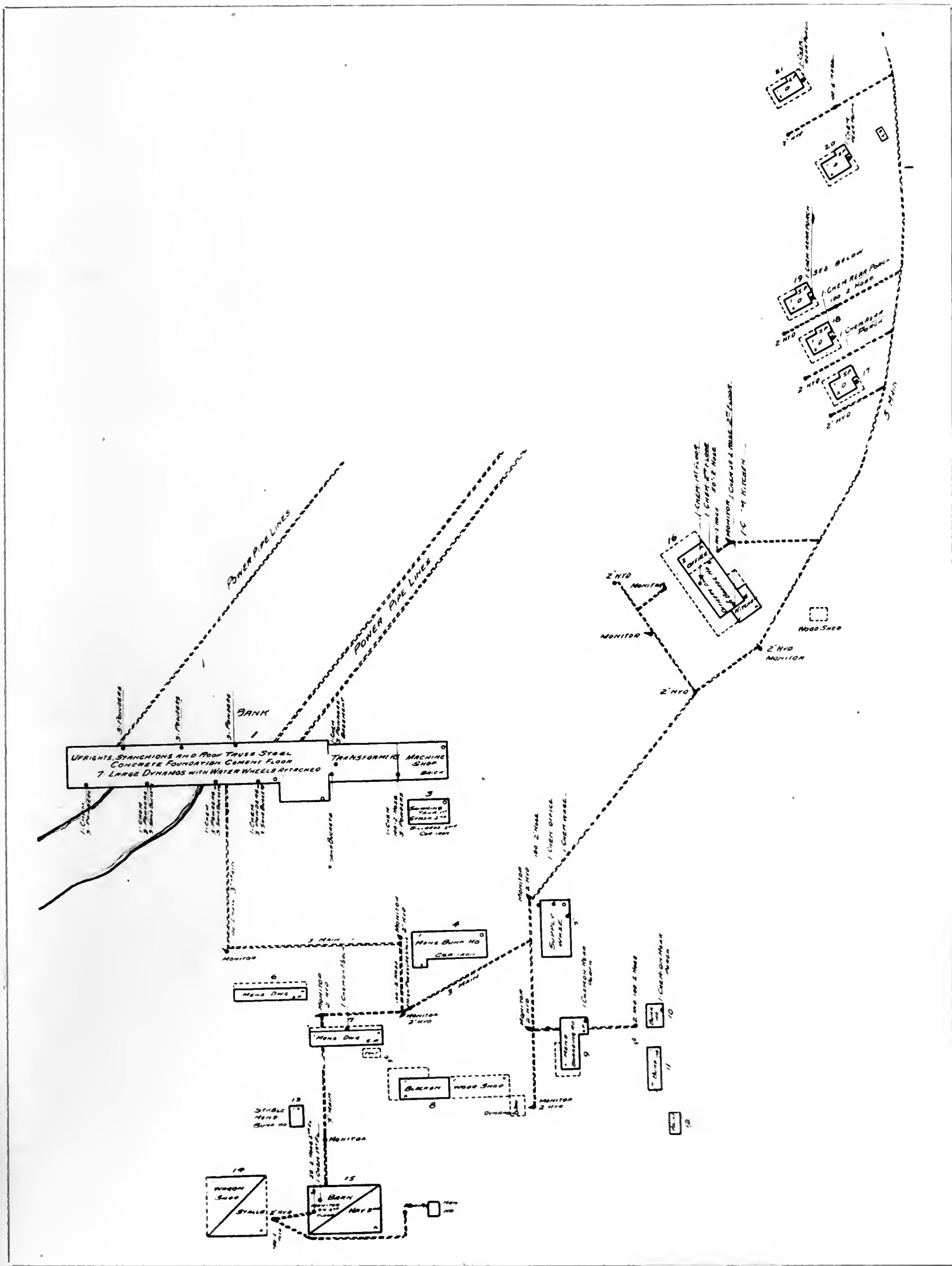
The engineers who designed the original power plant at Electra in Amador County bore well in mind the dangers from fire. The well laid-out water-pipe system shown in the accompanying diagram illustrates their forethought. With an abundant supply of water on the hill above the plant, it was easy to pipe it down to the buildings and create a natural gravity force exceeding that produced by the modern fire engines of a large city.



A fire drill at Electra, using three monitors and a hose-line focused on the warehouse

Electra's mail stage is shown. On the roof is Alex. Moran, operator; beside the fire extinguishers are (left) Weldy S. Yeager, (right) Will T. Jones, bookkeeper; on the extreme right is W. E. Eskew, superintendent, and man with cap is Archie Rice.

But water, to be effective for fire fighting, must be so confined that it may be readily handled and directed where it will do the most good. At the time the main pipe lines for a water supply were being laid at Electra the general work was in the construction stage. There was an additional menace of forest fires. It was probably considered advisable



and sufficient to equip these fire-fighting pipelines at intervals with what are known as monitors. They are nozzles set on standpipes, with swivel joints. A nozzle can easily be turned and the stream aimed at any given point within range. These monitors, however, were limited in their usefulness. Where a fire originated inside of a building or in an inaccessible place the stream could not strike. Modern demands have necessitated the installation of good, cotton, rubber-lined hoselines, located at convenient places and near the danger points.

Modern power houses and electric plants have also made a still further call for apparatus to overcome fires caused by burning oil and by electric flashes. So these large plants have been equipped with modern fire extinguishers, with sand in handy buckets to overcome burning oil, and with dry powder extinguishers to care for fires in electrical apparatus where liquid chemicals and moisture are to be avoided.

System is an important factor in the placing of fire-fighting equipment, stations placed at certain points at all times being advisable, in order that men may become familiar with apparatus and lose the least possible time in reaching it.

The diagram on the preceding page shows the concentration of water protection principally in connection with the frame outbuildings surrounding the main power house, chemical extinguishers in dwellings for immediate use in connection with small fires, and liquid chemical extinguishers, dry powder extinguishers, and sand buckets in the main, practically fireproof, power house building, to cope with oil and electrical fires.

The Kennedy Mine, near Jackson in Amador County, is down with a perpendicular shaft 3,500 feet, which makes it the deepest gold mine in the world. This mine has already produced $10,000,000. The Pacific Gas and Electric Company supplies it with electric energy for running its 100-stamp mill.

At the 22d annual meeting of the Pacific Coast Gas Association held in Los Angeles September 20th-21st seven of the fourteen papers were presented by members of this company. Sherwood Grover's was on Work Economics; Georke Kirk's, on Gas Leakage; John A. Britton's, on Necessitities for a Public Service Commission in California; John P. Coghlan's, on Prevention of Accidents; Lee H. Newbert's, on Suburban Distribution; R. J. Cantrell's, on Fire Insurance and Protection; and Leon B. Jones's, on "Experiences."

A letter from D. Arthur Bowman, bonds, St. Louis, under date of September 13th, contained this: "We wish to congratulate you on the excellent appearance and good quality of your publication. A good many publications of various sorts pass under the eye of the members of this office, but none surpasses in interest or attractiveness the one issued by your corporation." That means this magazine.

Late in August a forest fire near Quaker Hill in Nevada County seemed to be threatening the Deer Creek power plant, and about two hundred and fifty men hurried over from the mines in Nevada City and Grass Valley, some twelve or more miles, and coöperated with the forest rangers in fighting the blaze. The fire also threatened the flumes of this company's water system, which supplies Nevada City, Grass Valley, and other towns with water.

Electricity In Railroad Shops

How Power Is Used by the Southern Pacific at Sacramento

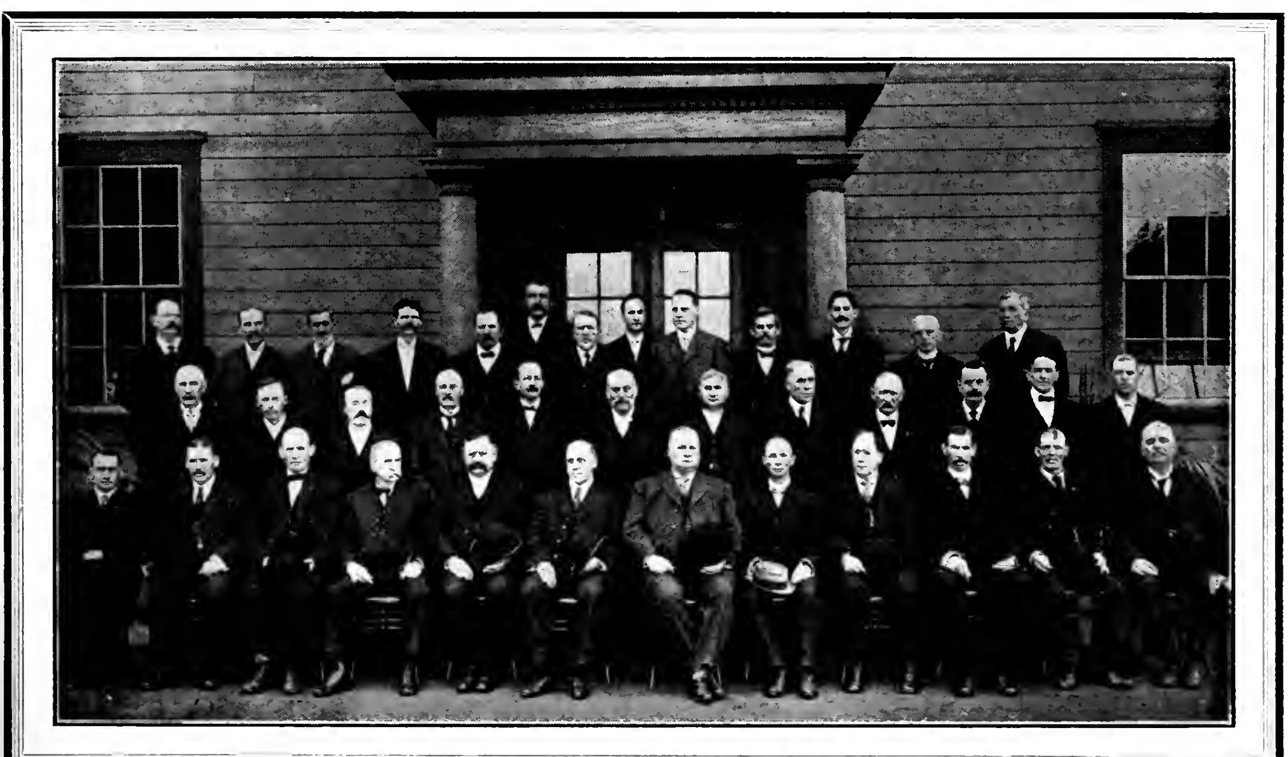
By C. R. GILL, Superintendent Sacramento Power Division.

C. R. Gill

When it comes to power, railroad shops are like all other industries; they need it. The shops of the Southern Pacific Railroad Company, at Sacramento, California, are the largest and most complete maintained by the Harriman system on the Pacific slope. They are located in the northwest corner of the city, covering practically all the space north of H Street and west of Sixth. They are equipped to do all kinds of maintenance, repair, and construction work necessary in the operation of a great railroad. When they are running at fullest capacity about 3,500 men are employed. July 1st, 1910, there was a total of 3,296 men on the payrolls of the shop alone, not counting road or station employees.

Soon after the Folsom power plant had begun in 1895 to deliver electric energy to Sacramento through twenty-two miles of a 10,000-volt line, at that time the longest and highest voltage transmission line operating, a contract was entered into between the electric and railroad companies whereby the electric company was to supply the railroad company with electricity for general power and lighting purposes.

The shops began operating under this contract August 10th, 1896. At that time the total connected load was 105 horsepower in alternating-current, three-phase, 440-volt motors; 25 horsepower in direct-current, 550-volt motors; 240 sixteen-candle-power, 120-volt, incandescent lamps; and 36 open-series, direct-current, arc lamps. Power for the alternating-current motors was supplied



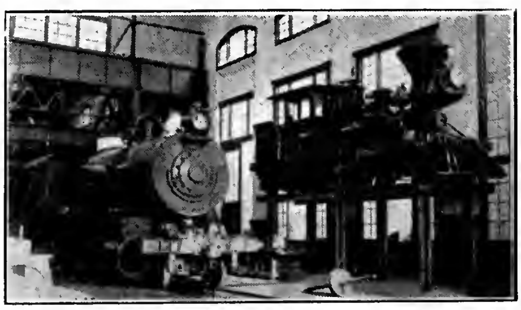
Heads of departments and foremen of the Southern Pacific Shops at Sacramento

In the locomotive machine shop, showing 130-ton crane equipped with six motors

from the substation at Sixth and H Streets directly at 440 volts, and a 2,400-volt line with distributing transformers took care of the incandescent lights. These circuits, with a 550-volt, direct-current and series arc circuit, completed the installation.

No changes were made in this system in almost ten years excepting the addition of copper on the 440-volt, alternating-current line. Then in March, 1906, a substation was built at a suitable location near the centre of load, and transformers having a capacity of 1,500 kilowatts were installed. This bank consisted of three oil-insulated and water-cooled transformers of 500 kilowatts, lowered in potential from 2,400 to 500 volts. They were protected on the primary side by an automatic overload release switch. The meters located in the transformer room are of the glass-encased, switch-board type, mounted

Transfer table used for locomotive work and operated by underground electric trolley



One of the first locomotives in service "over the hill"—Sacramento, California, to Sparks, Nevada

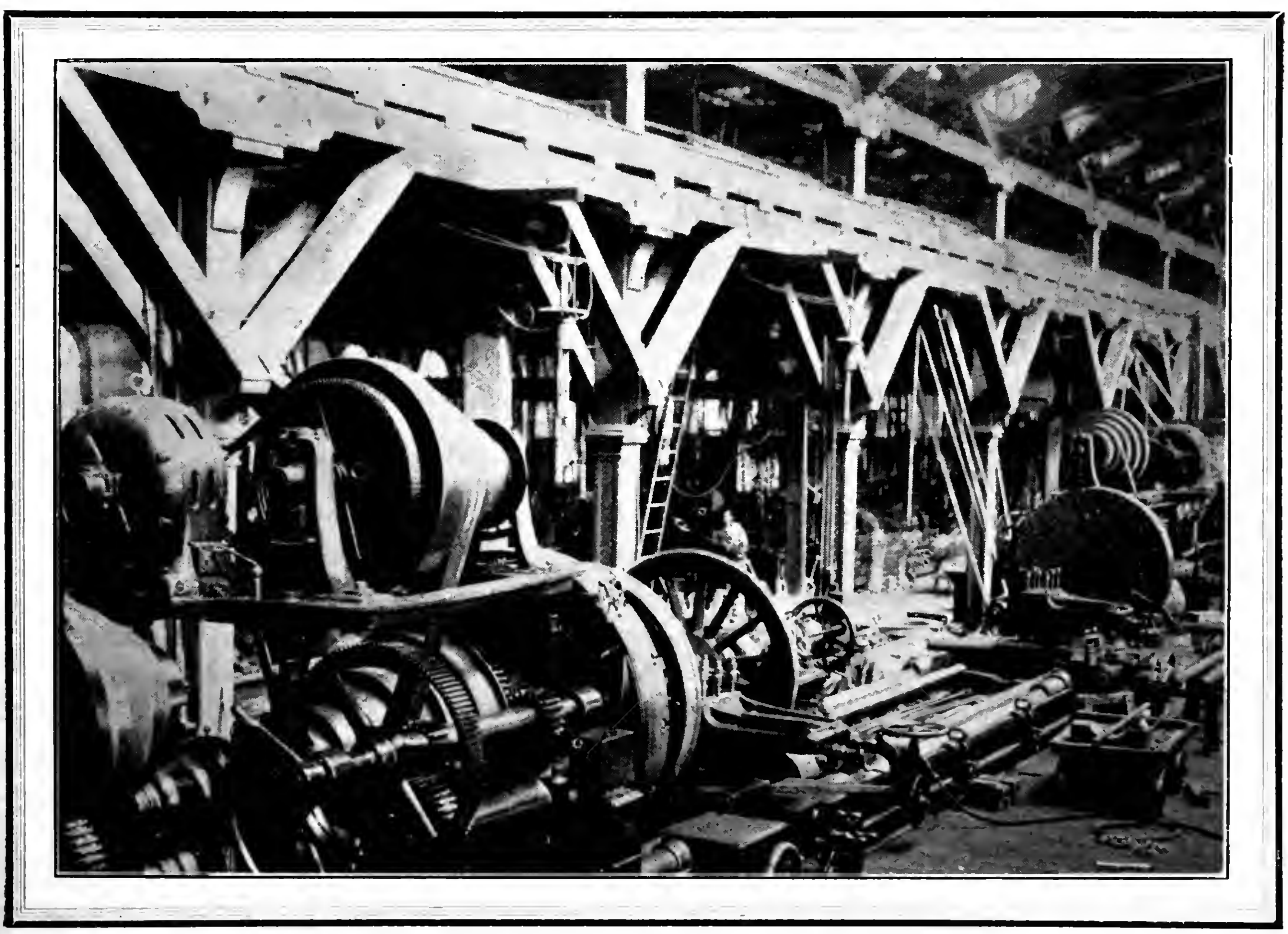
on a marble panel. The meters are on the low side of the transformers.

The present connected load consists of 2,900 horsepower in 133 alternating-current motors, ranging in size from one-sixth horsepower to 150 horsepower. In addition to the alternating-current power load there is a connected load of 620 horsepower in direct-current 550-volt motors, ranging in size from 5 to 80 horsepower. There is a total of twenty-four of these motors.

The lighting installation consists of 2,096 sixteen-candlepower incandescent lights, of 86 series direct-current, and of 285 multiple alternating-current arc lights. The series arcs are on an all-night circuit. They are mostly outside. The multiple lamps are used for general shop lighting when night work is necessary.

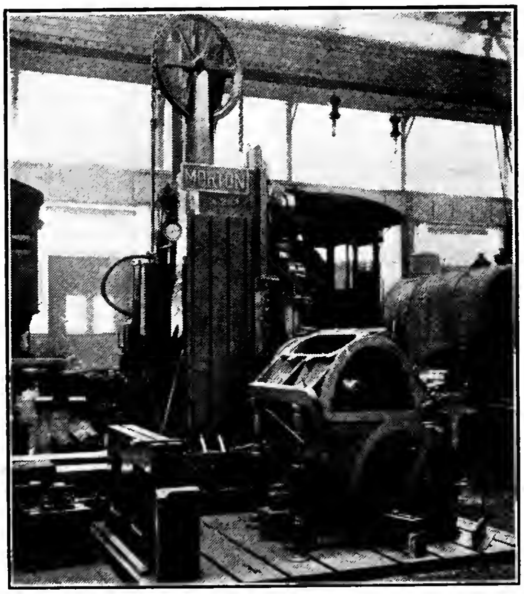
While the connected power load on the bank of three 500-kilowatt transformers is 2,900, the actual minimum demand is slightly below the capacity of the transformers. None of the machines is "over motored." But the comparatively low "demand" is accounted for by many of the motors on the heavier tools being of sufficient capacity to reverse early, while the normal driving power required is much less. Also, some motors are used only during certain hours, as in the foundry, where the blowers are operated only in the afternoon. All the alternating-current motors are of the induction type. As they run underloaded the greater part of the time they carry a low power factor, usually about 65, occasionally lower.

Electric power is used in the shops wherever possible. Necessarily it is put to various uses. The shops are equipped with a complete locomotive shop, bolt shop, foundry, rolling mill, carpenter shop, saw-mill, copper shop, tin shop, boiler shop, car shop,



A lathe that will accommodate a piece thirty-three feet long

paint shop, and electro-plating shop. Perhaps the most varied forms of power application are to be found in the locomotive machine shops, a large, well-lighted building 515 feet in length and 180 feet in width, equipped with nineteen pits, where as many locomotives may be overhauled at once. The locomotives are taken from the yard tracks on a transfer table, operated by a direct-current motor from an underground trolley, and placed on the pit tracks under a large crane where they are



A Morton draw cut shaper, large electric driven machine with 3-motor equipment

dismantled. This crane has a lifting capacity of 130 tons on a span of 76 feet 7 inches. The crane has a six-motor equipment, each of the two main hoists being equipped with 50-horsepower, direct-current motors with two auxiliary hoists of 20-horsepower motors, while two 10-horsepower motors propel the crane itself.

Many of the older and smaller machines are belt-driven from centre shaftings. But all the newer installations have individual drive, with variable-speed or single-speed motors, as the case may require. These motors are geared to the machines by tooth gear, silent chain drive, or rawhide gears.

The first railroad shops were established in Sacramento in 1855 by the Sacramento Valley Railroad Company. In 1863 the Southern Pacific Company's shops were established on the present site.

T. W. Heintzleman, superintendent of motive power, has charge of the entire shops. He is a railroad man of very wide reputation, and has been with the Southern Pacific Company at Sacramento since 1888.

The electrical installation and its operation are under the immediate supervision of William Trapper, a man of long experience. He has been connected with the company since May 1st, 1889. An inspection of the electrical equipment of the Southern Pacific shops at Sacramento convinces one that Trapper must be ever on the alert.

The first man to use gas in New York City was Samuel Legget, who lighted his house at 7 Cherry Street. People came to look at the strange sight, but kept at a safe distance, fearing an explosion, Newport, Rhode Island, and Baltimore, Maryland, soon followed New York as earliest American cities to try gas.

H. P. Pitts returned to the service of the company the 1st of August with the title of industrial engineer. He was born at Galt, Ontario, Canada, and there learned a trade and then established a machine-shop business. Galt is a manufacturing town of about 10,000 people, and every boy learns a trade or is not thought much of. From Galt Pitts went to Pittsfield, Massachusetts, and there spent several years with the Stanley Electric Company. Ten years ago he came into the Bay Counties Power Company as its chief draughtsman; then he was made assistant commercial agent. Then he was manager of the commercial department of this company up to three years ago, when he became purchasing agent for the Great Western Power Company.

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EDITORIAL

Deceit A Sign Of Degeneracy

In nature hypocrisy is rare. The mirage on the glimmering desert presents a luring lake. A famishing traveler prods on and on, pursuing that delusion, and dies. But only a very small part of the earth's surface is dangerous desert. Man has little need to go out into it. When he does venture the experience of others should teach what precautions to take.

In the animal kingdom there are a few birds that resort to pathetic deception. They pretend to be floundering away wounded upon the ground. It is the mother-instinct, risking her own life to protect her young.

Deceit, strategy, mother-love are there combined to divert a domestic menace too great for her to combat with her poor physical force. In such a case deception is justifiable. It is using intelligence to combat menacing destruction.

The more delicate and complicated any mechanism the more liable to get out of order.

The human mind is incomprehensively sensitive. It is affected by heredity, by environment, by food and famine, by sorrow, suffering, sickness, by joy, by alcohol, by drugs, by loss of sleep; favorably by the aggregate of all the uplifting influences; unfavorably by the total of all the degenerating experiences.

Nature is honest. In its unspoiled innocence the little child is frank, outspoken. Man at his best is naturally sincere.

Even a dog shows his feelings without deceit. His joy is real, his shame sincere when his master speaks.

Only man who has developed wrong is an impostor.

Decline toward degeneracy is marked by deceit. The drug-fiend can not tell the truth. Habitual insincerity, deception, lying are evidences of the individual's moral obliquity, of an abnormal mental condition.

When a person looks pale, emaciated, feeble there is something physically wrong. When a man habitually resorts to deceit there is something mentally or morally the matter with him. He did not begin life that way.

Intellect produces the power of imagination. At its best it has given the world great poets, writers, artists, inventors. Perverted, the power of imagination becomes an accessory to crime and depravity.

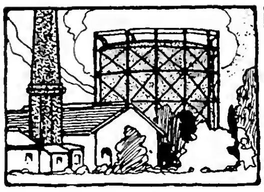
The thief, the coward, the degenerate lies as a matter of course.

The moral weakling moves along lines of least resistance. It seems easier to evade, to lie out of it, than to meet consequences and try to surmount personal weaknesses.

Among nations we have diplomacy, which is often artistic deception, to hide real purposes. The Japanese as a people, so recently emerged from isolated semi-barbarity, have carried the idea of diplomacy to extremes. Most of them prefer to use flattering deceptions in preference to frank truthfulness. As a people act so we judge the nation they form.

In the growth of the race the physically and mentally strong and normal are destined to survive the longest. The physical invalid can not fool the life insurance doctor; he is a bad risk. The man who lies, on whose word or promise no trust can be placed, is mentally or morally ailing; in business, in friendship he is a bad risk.

Lincoln and Gladstone did not smoke, and Roosevelt does not smoke.



MEN OF THE COMPANY

JOSEPH WARREN HALL

Who has been immersed in the fountain of youth and manages the Stockton Water Company

---

HERE is man of gentleness. If adversity has crisscrossed the path of his life it has left no traces. He is the big out-of-doors kind, tempered, perhaps, by having spent a portion of his time in the logging woods, where life is rugged and healthful and nature is roomy, inspiring, harmonious.

The other day three of us climbed, flight after flight, way up to the roof of the Sperry Flour Mills to get a birdseye-view photograph of the civic centre of Stockton. "Huh!" grunted the photographer; "I left my focusing cloth down in the automobile." "Use your coat," I suggested. And there was our host, a score of years older than either of us, hurrying toward the roof door. "I 'll run down and get the cloth," he called back, smiling with that natural kindliness that has kept him young. In that little incident you get the quality of the man, his coöperating cheerfulness, his natural helpfulness.

Two hundred and fifty years ago an Englishman named Perley landed in Massachusetts, a score of years after the arrival of the Pilgrims in the Mayflower. The Perleys stayed in New England and married and multiplied through one hundred and forty years and many generations. By the year 1800 Perley had become rather a familiar name in that section of the United States. Then some of those that bore it began to migrate. They scattered westward. Others followed in later years. Now there is a great bulky volume of more than eight hundred pages called the "Perley Book." It is the genealogical record of the family in America. The public libraries in Massachusetts have copies, and the various descendants of the Perley family also possess the book.

In a printed commentary on the contents of that family volume some one has written: "It has its Wandering Jew, its Country's Wonder, its escapades in courtship, its triumphs in politics, and its stories of pioneering and of country-wide travel. It shows how the family's money built churches and schools; how its ministers, doctors, lawyers, and teachers were ornaments to their professions; how its statesmen, by efficiency and integrity, enjoyed repeated elections; and how its men with the hoe, the trowel, the saw, and other implements of their craft, by diligence, enterprise, and sobriety, reared happy homes and garnered wealth."

Putnam Perley was a member of this numerous and interesting Perley family. He too went out into the west; chose the wilds of northern Illinois in the days before there were any railroads, and took up government land. A pioneering life on what was then the frontier increased his natural ruggedness; and he developed with the new country, became a sturdy citizen, filled various offices of public trust, was a life-long and ardent supporter of the church, and an uncompromising Puritan of the old stamp to the end.

The wife of Putnam Perley was Sara Dow, a graduate of Mount Molyoke Semi-

nary in Massachusetts. Delicate of physique, refined, accustomed to the eastern civilization of that time, she went with her husband out into the strange west and bore him eight children. Then came the almost inevitable result of a too hard life in what was yet a wilderness, the frail mother succumbed to the rigors of climate, and the flock of little children no longer knew her care and love.

On her deathbed she gave her little son, Joseph Warren Perley, into the keeping of her sister, who was the wife of Doctor E. Hall. And the little boy took his uncle's name, and was brought up and educated as a member of the Hall family.


Joseph Warren Hall

Doctor Hall had settled at Rockford, Illinois, when the little, motherless boy was three years of age. At six the child was started in school. When he was sixteen he finished the high school. Then he secured a place as office-boy in a bank at Rockford. He remained in the employ of the bank six years, the last two as bookkeeper.

But he was twenty-two then, and it was in the year 1869. The first transcontinental railroad had just been completed to California. The old Perley migratory spirit had begun to stir in his blood. The time had come when he wanted to go west. Within three months after the railroad had opened its line he was on his way, with a light heart and a light equipment.

Of his railroad ride across to California he has written: "It had rained for two solid months prior to and during my trip. The downpour was tremendous all the way over. The newly constructed railroad bed was soaked and uneven. The train was several days behind in its schedule in getting across. The storm in the Black Hills was terrific. For miles the telegraph poles lay prostrate. They had been shattered by lightning. The cold was intense. At Omaha the streets were bottomless. The hotels were damp to the core. The trip to Salt Lake had to be made by stage as no connecting railroad had yet been built. The interminable rain continued until we had passed the summits of the Sierras and had begun the descent of the western slope. The change to California sunshine after the depressing influences of the preceding few weeks was so delightful that I have never since felt a desire to leave this balmy country."

Upon his arrival in California he went into Napa County and secured a position as bookkeeper at the Redington Quicksilver Mine.

When he arrived at the mine that property was then in its prime as a producer. The company owned a ranch of 10,000 acres surrounding the mine. For nine years he remained there as bookkeeper. Then he went to Oakland, and for three years was engaged in business on his own account. During that Oakland period he married. Five children came to the family; three of them, a son and two daughters, are living. The son has a little daughter now a year old.

From Oakland he returned to the employ of the men who had owned the quicksilver mine, and in their interests he went to Folsom as manager of the Natoma Water and Mining Company and of its young vineyard of 3,000 acres near Folsom. There he remained three years. That was a decade before the Natoma company evolved into the Folsom power plant, one of the earliest hydroelectric installations on the American continent. From Folsom he went down to Pasadena and spent a year there as manager of C. T. Hopkins's orange plantation. His vineyard experience at Folsom opened the way to his securing the management of the Barton vineyards near Fresno. So he moved from Pasadena's orange groves to the raisin centre of the world, and for seven years was in charge of the Barton properties.

But again he came back to his old business associates—the people that had owned the mine and its allied investments. They made him acting manager of the American River Land and Lumber Company, with headquarters at Placerville, and also acting manager of the concern now known as the Sacramento Electric Gas and Railway Company, which is a part, like the Folsom power plant, of the great system of the Pacific Gas and Electric Company of today. For nine years he held these dual managerial positions. Then, ten years ago, he moved to Stockton as manager of the Stockton Water Company. Now that too is a part of this comprehensive California concern that supplies electricity to one hundred and fifty-eight communities, gas to thirty-three cities, water to seventeen towns, and irrigation to about 14,000 acres of orchards.

He looks the part of a man who has enjoyed and is still enjoying his life. Hard work has not hardened his nature. And he says himself that he would not exchange his experiences in California mining camp and forest for any thing that could be named.

We salute you, young grandfather! You are as young as many of the boys who are only half your years. What is the secret of prolonged youth? Is it cheerfulness, gentleness, kindliness, and being much out-of-doors? A. R.

William A. Handcock, who came to the old Bay Counties Power Company nine years ago to take charge of its telephone system, died in San Francisco Sunday the eighteenth of September, aged forty-two. In latter years he had been doomed to live a life of lameness and illness. He was engaged in construction work at both the Centerville and the De Sabla power plants during the period of their building. Later he was employed in the company's district office at San Jose.

E. C. Monahan, who has been superintendent of the company's Stockton power division since it was created the first of last April, had an interesting electrical experience in South America. Prior to going to the southern continent he was from 1901 to 1906 in charge of the electrical department of the Tacoma Smelting Company's plant in the state of Washington. Late in December of 1906 he was engaged by the Cerro de Pasca Mining Company (a Pierpont Morgan-J. B. Haggin concern capitalized for $10,000,000) to go to its big smelter at Tinahuarco, Peru, nine miles from its copper mines at Cerro de Pasco, and take charge of its electric plant generating 2,100 horsepower. The town of Tinahuarco, where the plant was located, is the highest city in the world; its altitude is 14,000 feet. The mines supplying the smelter are the most extensive copper property ever developed. There are 75,000,000 tons of copper ore in sight, and the company employs 6,000 men, but only about a hundred of them are white. Monahan now speaks Spanish quite naturally; and so does Mrs. Monahan. Such is the result of their high living (14,000 feet!) in Peru.

Revival of Hydraulic Mining at Smartsville

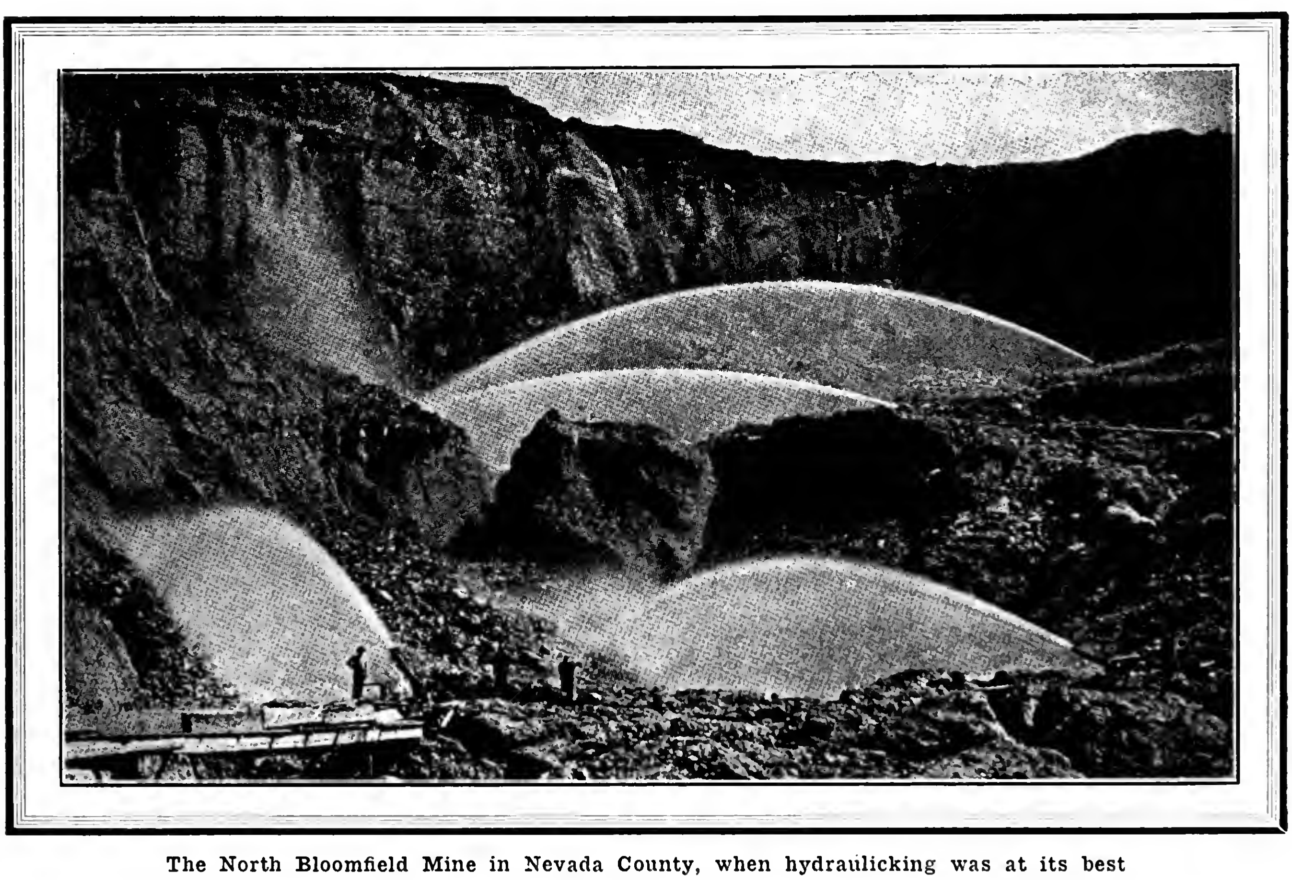
By C. E. YOUNG, Superintendent Marysville Power Division.

C. E. Young

A dredging machine has been devised to scoop the washings of hydraulic mines out of a big catchment hole. Thus ingenius man would avoid the legal restrictions that prohibit hydraulic washings from being allowed to go downstream and clog up California's navigable rivers. One of these new-method dredgers is being constructed at Marysville for use at Smartsville, that section of Yuba County where hydraulicking tore hillsides asunder for several decades, and then was forced to quit because the valley farmers outvoted the mountain miners in the legislature.

Back in 1856 R. L. Crary began hydraulic operations at the Blue Point Mine in Sucker Flat, near the present town of Smartsville, up in Yuba County. That method of mining by employing the terrific force of water shot from big nozzles made Smartsville a busy centre up to a score of years ago. Smartsville was a place of about 3,000 people. Today it can hardly boast 200. When hydraulicking ceased the miners left and Smartsville ceased looking smart. It slumbered. Now it is to awaken.

In the old days water was brought down to Smartsville in a thirty-two-mile ditch from Wolf Creek in Nevada County and was delivered with a drop of 325 feet and squirted through four-inch or nine-inch nozzles to eat away hillsides and flush them into wooden flumes in which the gold would lodge back of the numerous little cleats or riffles of wood. All that dissolved floated on, and the rocks and stones were thrown aside. It was a rough and ready way of mining, with no regard for the appearance of the landscape. Immense gravel banks were washed down



The North Bloomfield Mine in Nevada County, when hydraulicking was at its best

through sluice boxes and the precious yellow dust, grains, flakes, or nuggets saved. The sand and gravel and mud went on down through an eight-by-eight-foot tunnel 2,300

Blue Point Gold Mine operating monitors at Sucker Flat in 1856

feet in length and dumped into the main channel of the Yuba River.

But in 1888 hydraulic mining was abandoned at Smartsville. Thirty-two years of that steady contribution of sand and gravel and mud was filling up river channels and leaving them too shallow to hold the winter floods. Farming lands were overflowed and farmers were not overjoyed.

In 1907 the Tarr Mining Company bought the old Blue Point Mine there at Smartsville, and E. W. Tarr himself took charge. It is his idea that a dredger can be made to scoop hydraulic washings out of a catchment hole and the gravel and sand be safely dumped on land owned by the mining company.

So those old mining ditches are being cleaned and enlarged throughout that thirty-two-mile stretch from Wolf Creek. Two immense derricks, each capable of handling twenty tons at a single lift and swinging it around and dumping it anywhere within a radius of two hundred feet, are being installed to hustle the boulders.

The dredger will be stationary and stand by the hole into which the washings will come. The machine is being built at the Yuba Construction Company's shops in Marysville. It will be set up at the base of the Blue Point Mine's gravel channel, and its endless chain of steel buckets will gouge out and bring up the gravel and sand from the sump in the channel.

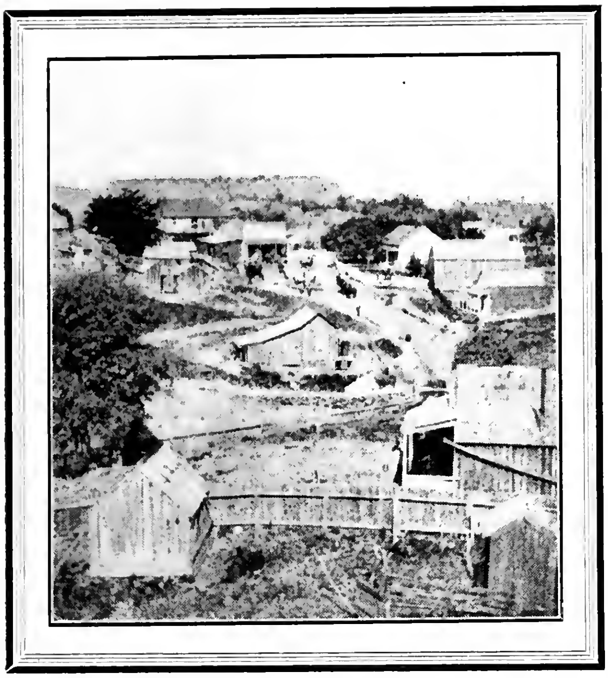
The gravel and sand will be hydraulicked down into that sump in much the same way that it used in the early days to be washed down into the sluice boxes.

The process of getting the gold from the gravel and sand will be the same as that familiarly employed by the regular gold dredgers in use on the Feather, the American, and the Yuba River. What that method is and how electricity is used in the process was explained in the May number of this magazine in an article entitled "Gold Mining by Electric Dredging."

This big stationary dredger that is to revive hydraulic mining at Smartsville is to be

Pay-day at Sucker Flat in 1856

equipped with electrical apparatus, and the electric energy is to be supplied by the Pacific Gas and Electric Company. The dredger will require about three hundred horsepower.



Dan Dougherty's at Sucker Flat in 1856

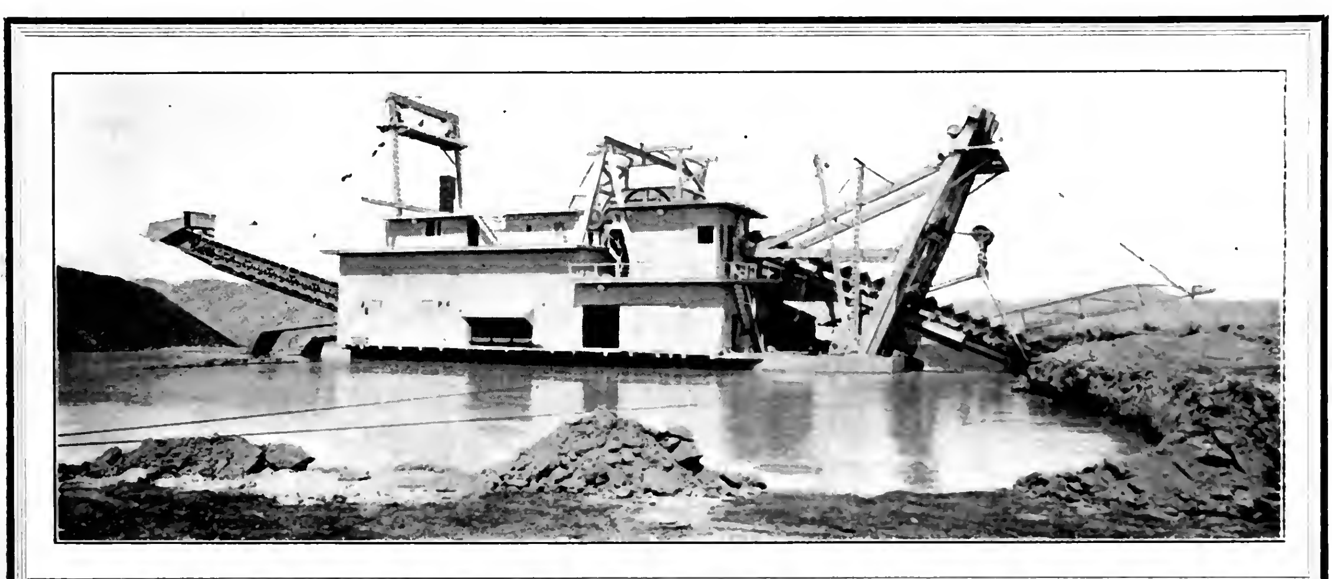
In expectation of this need a substation is to be erected at Smartsville with the necessary transformers. The result is that the little, old, mining town is beginning to look forward to the not distant time when its houses will be lighted by electric globes and the era of the tallow candle and the kerosene lamp will have passed for Smartsville. As three of this company's sixty-kilovolt power lines pass right through Smartsville it will be assured of having service for any emergency.

So hydraulic mining is to be revived in California at a place where it was a great industry for more than thirty years. Gold mining in California has long since become so much a matter of plain, prosaic business that very little attention is given to the subject. It is a settled and old-established industry. The picturesque days are passed. The time of poor-man's strikes are gone. Companies own and operate, and sentiment plays no part.

And, yet, there are more than 23,000 men regularly employed in mines in California. But you scarcely hear of them. The mining industry in California is big to the extent that there are more than seventy mineral substances mined, quarried, and gathered in the Golden State. Out of her gold mines alone have been taken in the last sixty years no less than one billion five hundred million dollars, or at the rate of twenty-five million dollars a year for sixty years!

In California there are now about 3,500 quartz mines regularly producing bullion and about 7,000 that produce gold now and then, produce their own publicity, or sell stocks to the gullible. Also there are about five hundred placer gold mines in California, and several score gold-dredger mines.

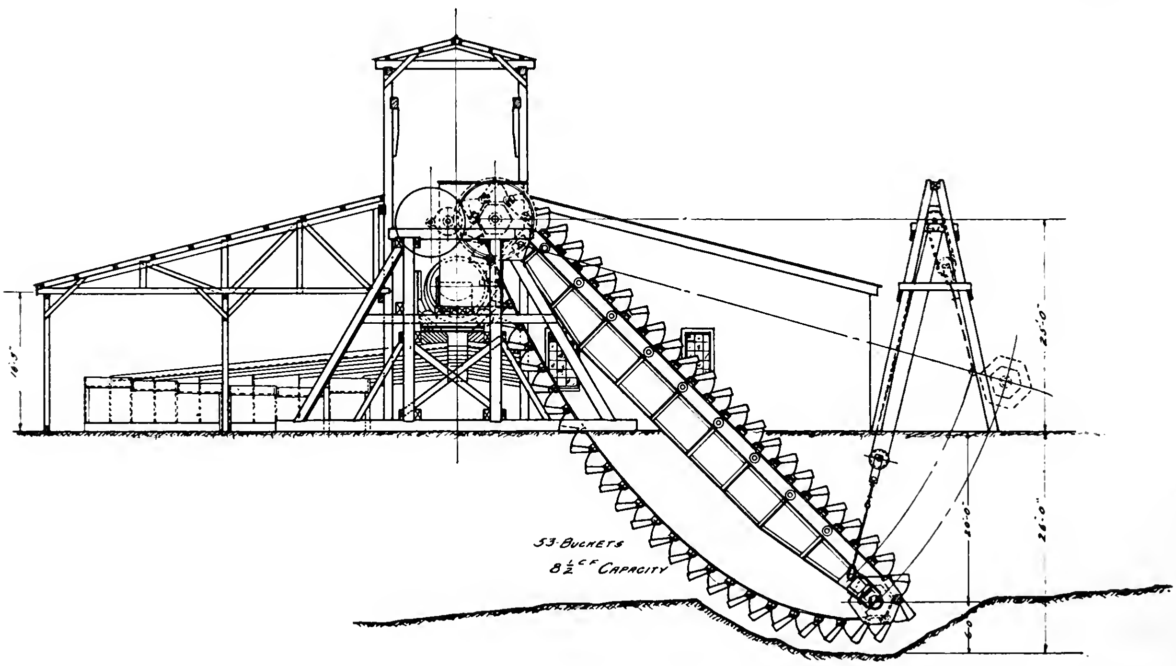
But to revert to California's varied mineral products. Most all her fifty-seven counties



A typical, big, dirigible dredger working in a California gold field.

market mineral. Alameda leads in the production of salt, macadam, manganese, and coal; Butte leads in mineral paints; El Dorado in slate; Inyo in soda, lead, and marble; Kern in petroleum and antimony; Los Angeles in brick clays, gypsum, and sulphur; Madera in granite; Napa in commercial mineral waters, quicksilver, and magnasite; Nevada in gold and pyrites; Placer in pottery clay; Riverside in asbestos; San Bernardino in borax, cement, and limestone; San Joaquin in natural gas; Santa Barbara in asphalt; Santa Cruz in lime and bitumenous rock; Shasta in copper and silver; and Sonoma in paving blocks. Of course many of these counties also produce large quantities of other minerals, and other counties also produce some of these, but the counties named are the leaders in those particular substances.

Up in Nevada County, the banner county for gold, is the North Star Mine. It has been regularly producing for a great many years, and has yielded up $30,000,000 in gold, the best record of any California gold mine. Then down in Santa Clara County, about sixty miles below San Francisco, is the oldest mine in California, the oldest quicksilver mine in the United States. The Mexicans began operating it back in 1834. It is the remarkable old New Almaden quicksilver mine, not far from San Jose. For eighty-six years it has been a producing property. It has one hundred and ten miles of underground passageways threading the mazes of the ledges under a tract of land that covers an area six miles long and four miles wide on the surface and embraces 8,580 acres. Out of that old mine they have taken more than one billion five hundred million pounds of quicksilver.



Profile sketch showing the proposed new stationary dredger and the catchment hole for hydraulic washings

Mining! Why, California is mining all the time, and delivering the goods, too. And electric energy is playing an important part in all the more modern methods of working California's mines in the most economical manner.

Gas service was inaugurated in the town of Sebastopol by the Pacific Gas and Electric Company late in August, and the local representatives celebrated by keeping open house the first evening the lights were turned on. The main was run from the gas works in Santa Rosa, and a gang of workmen was busy about a month laying pipes in the streets of Sebastopol.

A Peculiar Explosion

THE Diamond Match Company's power house at Chico was wrecked by a remarkable explosion that occurred August 6th at 12:15 in the noon hour.

The accompanying picture shows the effect of the explosion.

At first it was thought that a boiler had exploded. But upon inspection it was found that the sawdust and other material in the fuel bins, between the engine room and the boiler rooms, had caught fire and formed a gas and that the gas had exploded.

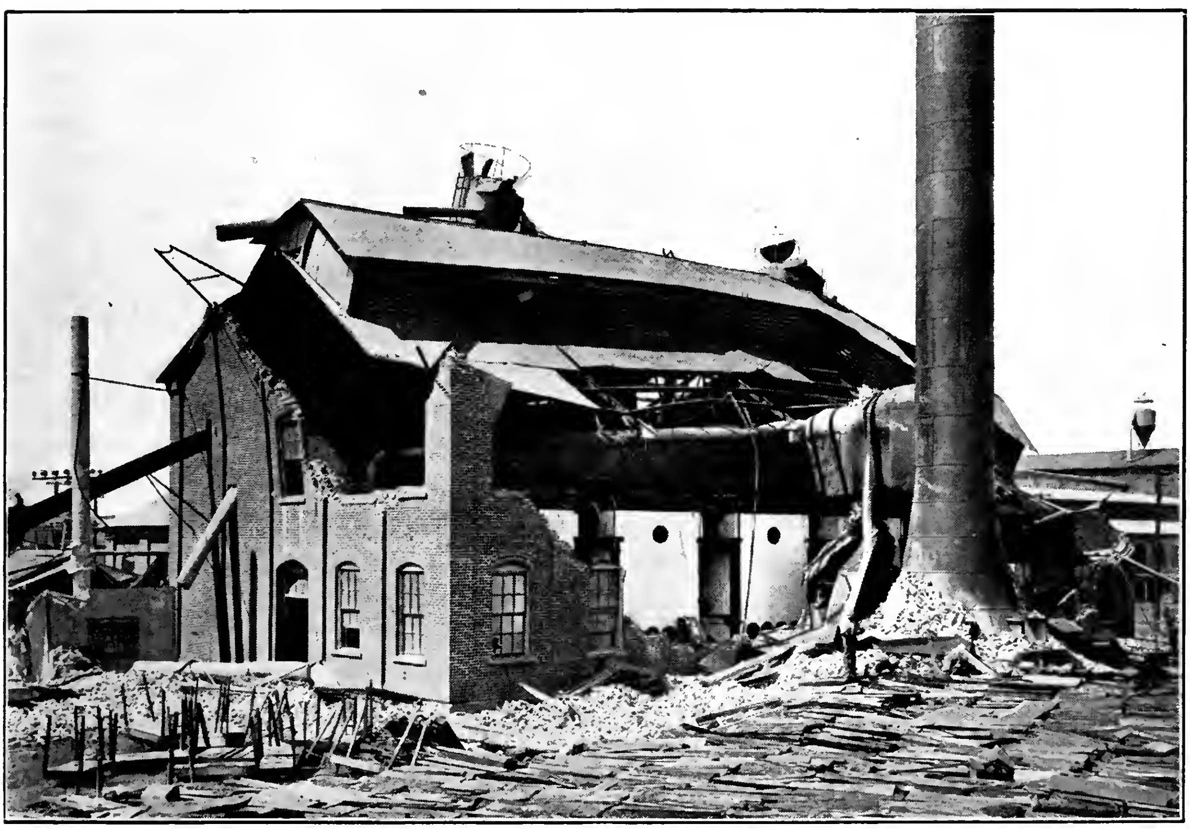
Six men were severely injured, one of whom died August 10th.

The Pacific Gas and Electric Company had taken over the Diamond Match Company load of about eight hundred horsepower at 6:35 p. m. July 22d, 1910, and had been carrying it ever since.

The plant is shut down now, as there is no way of disposing of the refuse from the mills.

The electrical apparatus of the plant is uninjured. Operation was resumed August 15th.

The boiler plant will be out of service for some time. Steam is used in the dry kilns and fire pumps. After the explosion the fire pumps were being furnished with steam from a locomotive.



Diamond Match Company's Power House at Chico After the Explosion

The explosion was of so unusual a nature and the wreck so serious that I thought it would be interesting to the readers of this magazine.

C. E. Young,
Superintendent Marysville Power Division.

Business Value of Good Will

By GEORGE N. STROH, Adjuster San Francisco Gas and Electric Company.

George N. Stroh

Good will has no visible, tangible existence. But under the law it may be considered as property. It is capable of being bought and sold. In many cases it is the main contractual consideration when a business changes hands. In lines of trade dependent upon transient patronage good will may be a negligible factor. As such it has little or no commercial value. But where it depends entirely upon the merit of some particular manufactured article which has won its way by its inherent excellence, or the seller has, by his personal efforts, built up a business and agrees not to engage again in the same line, or at least, not in the same community, it is legally classed as a valuable consideration. Defined, it simply represents the good feeling a customer entertains for a certain concern, either by virtue of the excellence of its goods, or the considerate treatment that may have been rendered him. He is accordingly satisfied to continue his patronage in the event of a sale or of competition.

In no line of business, possibly, is good will so valuable a factor as it is in the gas and electric industry. This is so for the reason that the business is dependent for prosperity upon the continued patronage of its customers. Owing to the economic waste incidental to the paralleling of expensive supply systems and duplication of plants, with the resultant demoralizing slashing of rates by the new companies to secure business, the confidence instilled by fair treatment often disposes a customer not to make a change, even in the face of lower rates. In these days of municipal ownership agitation good will, or the attitude of the general public toward a corporation, acquires a peculiar significance and value. All gas and electric publications of the present day devote much space to the matter of the importance of cultivating the friendly feeling of the public, where a decade ago the subject was rarely if ever mentioned or discussed at conventions of gas and electric men.

While prompt and efficient service is undoubtedly important and necessary on the part of a public-service corporation, its visible embodiment exists in its representatives. As a large percentage of the employees comes into constant personal contact with the customers, and all employees of whatever nature have their circle of friends and acquaintances, their united efforts toward influencing a friendly sentiment on the part of the public and dispelling prejudice is a matter of no small value. It may be the means, at critical periods, of preventing hostile and unfair legislation.

An employer is held responsible for the acts of his representatives. Frequently the memory of a slight or of arbitrary treatment is harbored for years, to react against the company at some future day, possibly long after the offender may have left its employ. The writer recalls an instance at the period of the close competition of the various companies in San Francisco during 1902, prior to their consolidation in 1903, where, in a certain district, the company with which he was then connected lost many good customers, the cause being directly traceable to the sarcastic, high-handed treatment they had been compelled to endure for years at the hands of one of its employees. On the other hand, a recent occurrence, there was a customer going into business where her bills would easily run over $150 a month. She voluntarily gave this company the preference in the face of keen competition, for no other reason than that she had always received fair

treatment at her old location in the past. This would prove, considered merely from the standpoint of business policy, to say nothing of a customer's right to expect courtesy and consideration under any and all circumstances, that the cultivating and establishing of good will means the building up of a valuable asset in any line of business, but more particularly to a quasi-public corporation.

The Tail of a Snake

MANY men see snakes that are never killed. Some body sent an August number of this magazine to the proprietor of the Sierra Casa Rancho at Colfax, Placer County, California. This rancher relates an experience seeing just one snake, and claims he killed it. At any rate he sent the magazine the rattling end of a snake (twelve and a button) and a letter, which evolved into verse form, inspired possibly by something associated with the death of that snake. He confesses that he filled up on bad whiskey before the snake had a chance to bite him, thereby circumventing the emphatic warning that whiskey is dangerous after a snakebite. He then let the snake get one whiff from the flask; and the rattler silently coiled up and died!

But here is his story:—

Permit me to thank you for the "Pacific Gas and Electric Magazine," and allow me to compliment you on its contents and appearance. Publications of this kind do a great deal in bringing about that unity of interests which should exist between employer and employee.

The article on "Rattlesnake Bites and Cures" very much interested me, particularly so as I had the pleasure of dispatching a rattlesnake the other day, and from the size of the rattles I am enclosing you can judge he was not a small one.

With this I am sending the tail of a snake.
You can see at a glance it's no nature fake.

I was on my way to New England Mills.
The day was warm and clear.
The birds were singing their sweetest trills.
The echoes sounded far—then near.
The moon-eyed cows were chewing their cud.
The calves just romped with glee.
A shaggy donkey was standing in mud
In the shade of a live-oak tree.

A coon ran out from a hollow log.
A squirrel peeped out from its nest.
From afar came the ky-yi of a dog
As it gave a wild-cat no rest.
In a pasture field stood a fallow deer.
A rabbit ran out in a clearing.
A coyote's call seemed very near.
A skunk's scent showed what I was nearing.

I stood for a moment in rapture lost.
I cared nought for the cow, skunk, or heat.
The cares of the world from off me I toss'd.
When—horrow of horrors! right at my feet
Coiled up, tongue out, ready to strike,
Eyes bloodshot red, its body curved,
Was a snake. In size I'd ne'er seen its like.
Its aspect was fierce. I became unnerved.

I thought of the magazine to me had been sent
And the picture that in it I'd seen.
I thought of the rattler's venomous intent
And the thousands of deaths that had been
Caused by the sting of the deadly snake;
How its poison would course through the veins,
And if a dose of strychnine you could not take
Much whisky would put end to your pains.

I drank from my bottle till it was most dry.
I drank to my very fill.
The more I drank the more resolved I
That snake I would certainly kill.
I looked round for a stick or a stone—
A something with which to slay;
My search was in vain, I could find none,
And the snake was getting away.

I took from my pocket the flask I had;
Some of the whisky I poured on the ground.
The fumes of that whisky were certainly bad,
For the next thing—a dead snake I found.
So I send you a tail—'tis the tale of a snake.
Like others, from whisky he died.
'Twas not the amount the poor fellow did take,
But the trouble it gave him—inside.

The aerial cable across the Feather River from the Western Pacific Railroad to the power plant at Big Bend in Butte County is two hundred and sixty feet above the water and is strong enough to carry across a railroad locomotive. It has transferred thirty-seven tons at one load.

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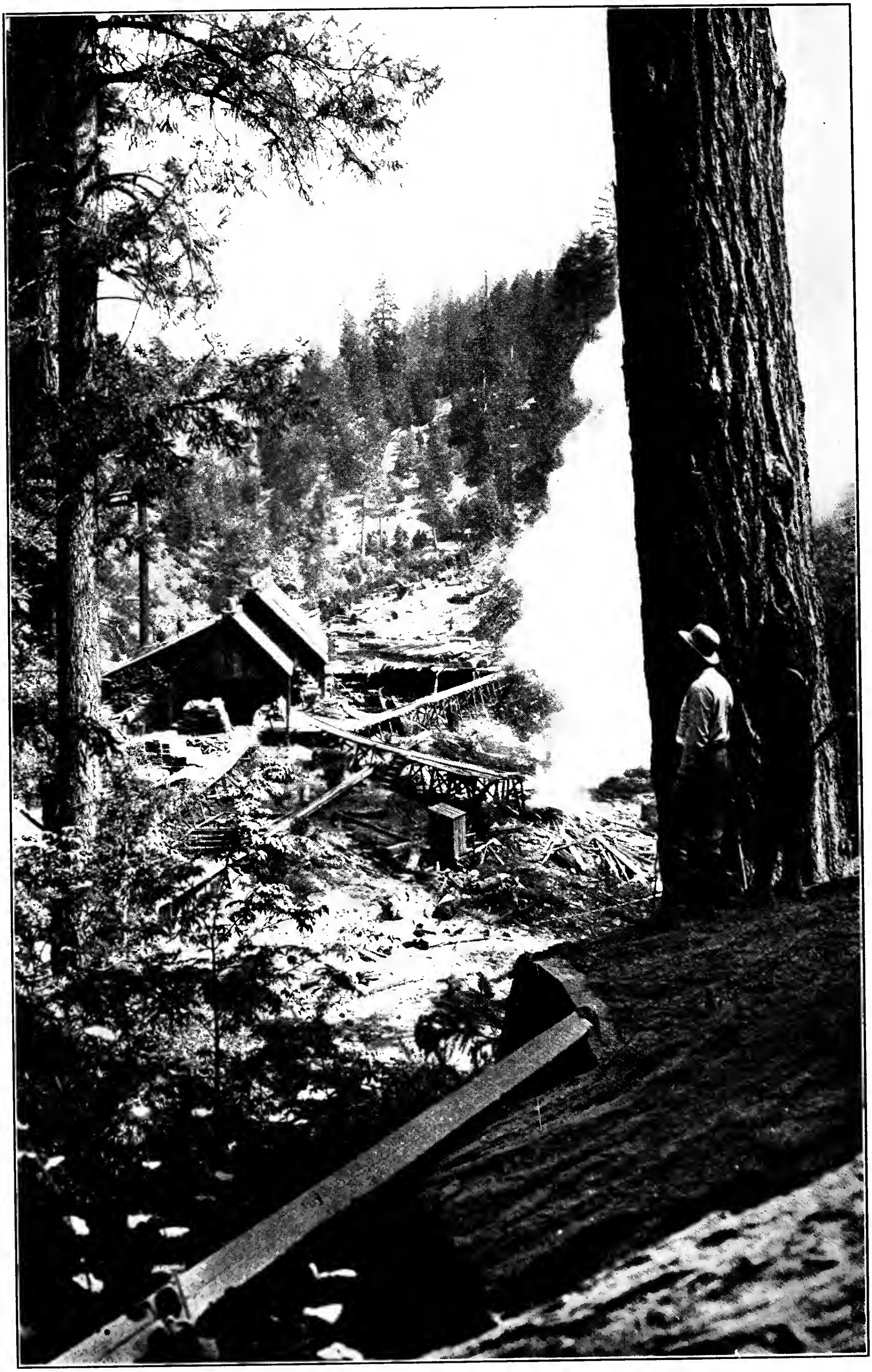


A GLIMPSE OF THE PACIFIC GAS AND ELECTRIC COMPANY'S TIGER CREEK SAWMILL, UP IN AMADOR COUNTY, THIRTY MILES ABOVE THE ELECTRA POWER HOUSE

(Superintendent Eskew and Mill-foreman Johnson in foreground)

Pacific Gas and Electric Magazine

VOL. II OCTOBER, 1910 No. 5

A Visit to the Tiger Creek Sawmill

By ARCHIE RICE.


Archie Rice

"It's three-fifteen. Shall I call the other fellow?" You wonder drowsily what cost three-fifteen. Then you recognize your shoes in the swath of electric light that is making dappled silver designs on the floor after filtering in through the rose bushes on the porch.

What is this place? Oh yes! You are at the Pacific Gas and Electric Company's Electra power plant. You drove up last night a dozen miles from the old mining town of Jackson. You 're in Amador County, wherever that may be, and on the edge of the Mokelumne River. It does n't matter whether you can pronounce it or not.

You dress. Out on the great arcade porch of the boarding-house you stand in the silence of the night. Nobody is in sight. That unceasing droning hum is still coming from the power house. The high, clear vault of heaven is spangled with brilliants.

The superintendent and the photographer are to go up on the little cable tramway with you to the mountain top. Way up yonder a strange constellation glows above the lofty horizon.

"The lights up at the forebay," explains the superintendent, jerking his head upward.

You are going up there on faith and a slivery plank attached to a steel cable. Two mules and two horses have been led up the zigzag trail. They started an hour earlier.

You perch on a shelf that feels like a slice off an old doorstep. The photographer cuddles next below you. But he wiggles. Then he says something that disturbs the stilly solemnity of the starlit night. He extracts slivers as one might pluck tail-feathers in the moulting season.

The superintendent presses a button somewhere, and hurries onto his shelf.

Something quivers under you. Your spine jerks. The thing has started. You are going up backward. Up and up and up. You can 't see the cable. You hope it holds. The little wheels rumble under you irregularly.

Down below you, sinking slowly to be engulfed in a wonderful black yawning crater in the mountains, are the electric lights. The buildings are all blackness. It looks like some prison hidden away in the mountains.

Up and up you go backward. There is a man way up there behind you somewhere on the mountain top, standing at a great spool-like wheel that is winding that cable. There is two thousand four hundred feet of it. You hope he keeps awake. The lights down there in the cañon, the lofty ridges above it, and the million stars in a cold, clear sky take your whole attention now.

It is worth starting without breakfast to see such things.

One of the self-moving donkey-engines pulling in logs by cable from 1,000 feet out in the forest

"We ought to reach the sawmill about nine o'clock," the superintendent remarks. "We 'll get breakfast there. Hope you wore your oldest clothes. It 's dustier than the devil's ash-heap. I 'll ride the saddle horse if you 'll lead this big white animal behind the rig. You 'll have to follow me for a while till we come out onto the main road."

The photographer says he used to lead an orchestra in Vermont. So you let him do the leading, and you drive the mule team.

"Had to bring that rig round twenty miles to get it up here," says the superintendent.

The road skirts a mountain lake that twinkles its thousands of reflected stars. You sniff the odor of pine needles.

Suddenly the lights of a mining town burst upon you as you come out at the crest of a ridge. "What town is that?"

"No town. What 's left of a forest fire," shouts the superintendent from his saddle and the darkness ahead. "Fellows up here start forest fires to clear off underbrush; makes grazing land for cattle. Never can catch 'em at it."

You come into the wreaths of smoke. On both sides of the road the manzanita is crackling, smouldering, playing fitfully with dancing and vanishing tongues of flame.

On and on you drive. The photographer lets out a sudden grunt of pain. Instantly he says things in the language he used for the slivers.

The led horse has pulled back again and got loose. You stop. The photographer gets out and ambles back, muttering some primeval prayer of the forest or the jungle. He speaks to the horse, not kindly. The procession resumes the march.

Day has dawned. It is getting warm.

You come to a descent so steep that the collars threaten to go off over the mules' ears. They wrestle back stubbornly. Your leg is trembling with the extra force you are exerting on the brake. It is n't a road. Merely a shortcut down a mountain through a forest. The photographer says other things. Then he suddenly hurls himself far out and clear of the wheels. "Not for me," he yells as he flounders up on all fours. But you complete the long fight against gravity, make the final sudden turn into the real road down at the edge of a steep ravine. You are not far from the end of the thirty-mile ride to breakfast.

While you are waiting in one of the cabins for the belated repast to be spread on the long oilcloth table some of the men show you the skins of recently killed rattlesnakes and a collection of rattles gathered in the immediate neighborhood. There is a telephone in the cabin. The superintendent talks some directions back to the power plant and learns some things about load conditions at the moment down in Oakland, a hundred and fifty miles away. The company's whole system is spider-webbed with telephone wires throughout the twenty-six counties it serves with light and energy.

On the wall of a shack smeared big with a paint brush you read:

SAWED 40,938 SEPT. 24, 1907.

And near it, done in neater lettering is painted:

SAWED 51,194 AUG. 17, 1910.

Those are the little sawmill's best records for a day. The first one was established when H. M. Cooper was in charge there. He put

One of the gravity-road cars and its load of logs coming down the mile run to the log pond at the mill

up the mill. He was a forester and a lumberman from early boyhood training. His father had owned the old Cooper mill where the Deer Creek power house now stands in Nevada County.

The little Tiger Creek sawmill was started along about 1900 by the Standard Electric Company when it was building the Electra power plant.

The Tiger Creek sawmill operates only every other year. That gives all the lumber the company requires for its Electra flume system. It has another mill at Comptonville in Nevada County for its Colgate flume system. Usually about 2,000,000 feet are sawed during the short season at Tiger Creek. But things hum those few weeks. Seventy men and fifty head of work animals form the

The pond into which the logs are unloaded from the cars and out of which they are pulled to the log carriage. The smoke is from burning waste slabs cut off the four sides of each log

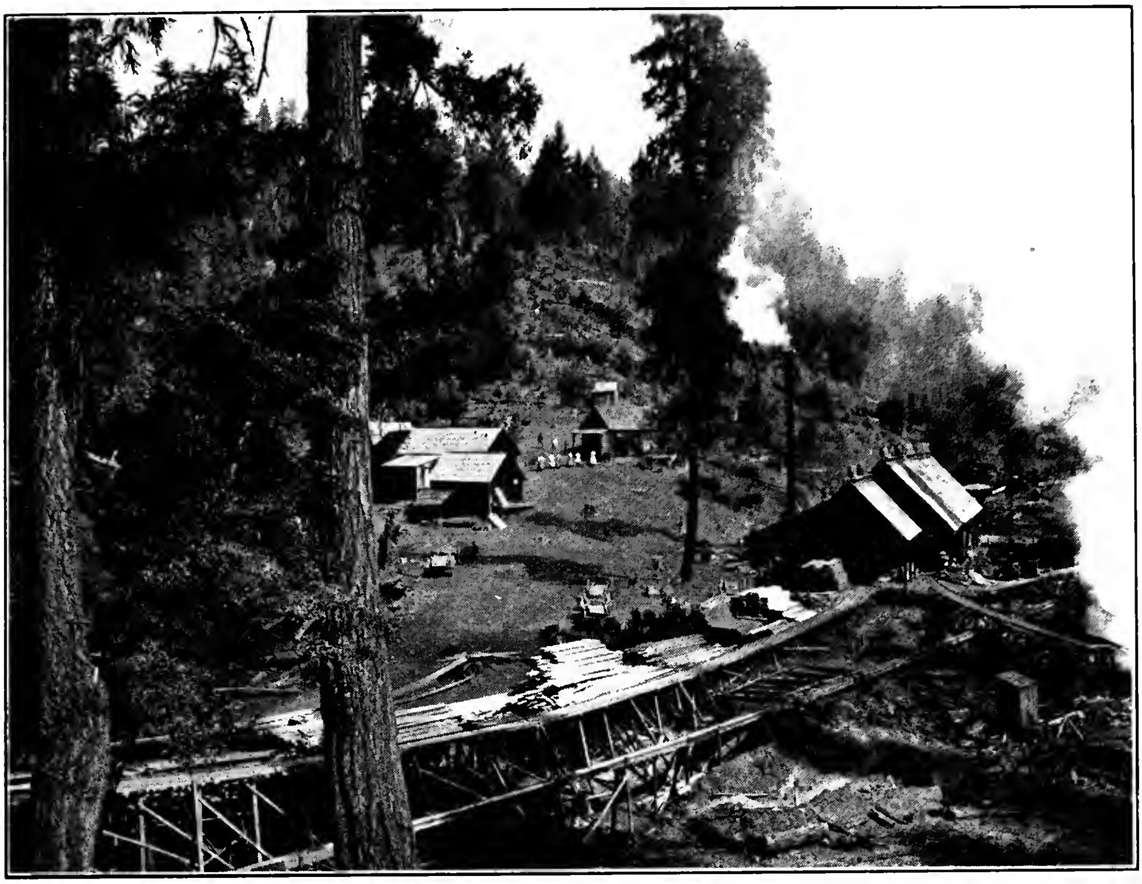
The timber tract about the mill is some three hundred and twenty acres. But to the northward the company also owns a tract of about 1,200 acres, where there are two hundred and forty acres of timber that has never been touched. On that area there are estimated to be 5,000,000 feet of lumber. The total timber remaining ready for the mill is figured at 12,000,000 feet.

moving force in forest and on trail and lumber road.

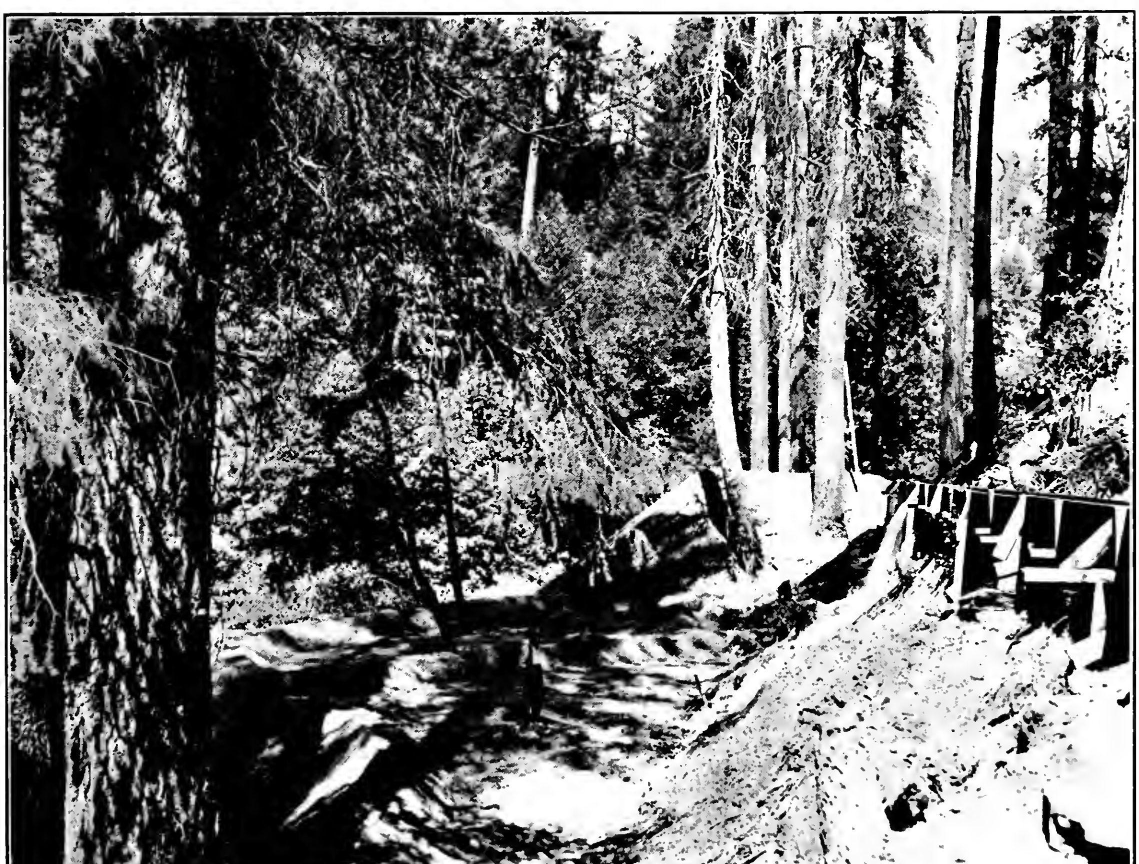
"We brought you up a horse to take the place of the one that got killed," remarks the superintendent to the sawmill foreman.

"That 's good."

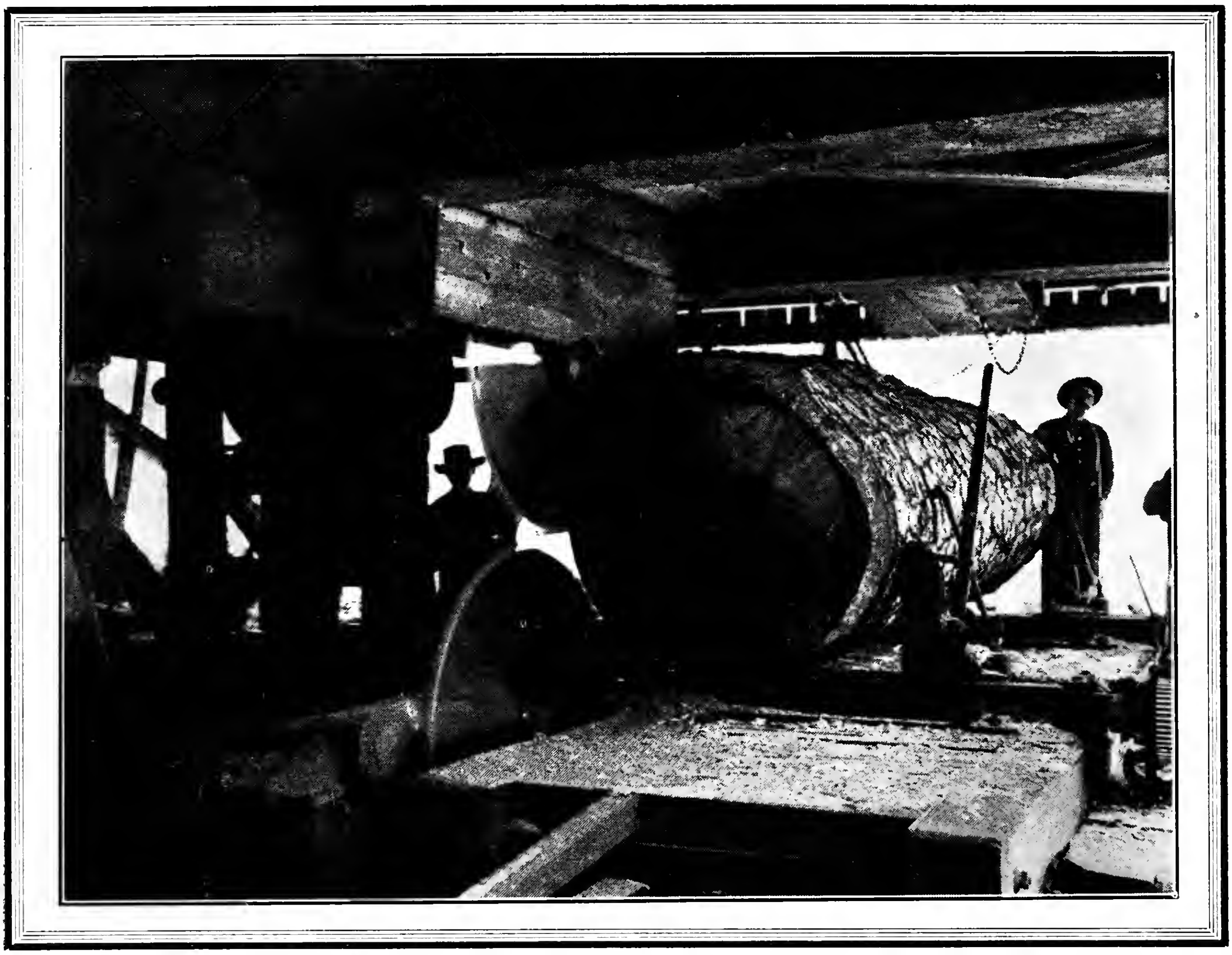
The photographer mutters something unintelligible without exposing his head from under the focusing cloth.



Downstream view of the mill, a little of the lumber output, the shacks, and the women-folk



Impounding sawdust sluiced down from mill to prevent interfering with Tiger Creek as trout stream



The two 55-inch circular saws snarling through a log in the process of slicing it up into lumber

"There was a runaway log car up on the grade. Brakeman got thrown off. One of the boys driving up empties heard it coming just in time. Jumped off. Tried to pull the horse out of the way. Not time enough. Big log-ends smashed the horse in the thigh. Knocked him over the bank. Broke his hip, I guess. We had to shoot him. Show you the place when we go up."

What 's the use of describing the mill and the surrounding forest? The photographer will do that so any one can understand the place and how it looks.

"Look out; one 's coming," cautions the foreman. The squeal of the wheels can be heard as the big log car takes the turns. Then on it comes, driving right at you. At the rear stands a reckless young devil wearing big gauntlet gloves. As he passes you see him hanging on to balance himself. His heavy-shod right foot feeling expectantly down upon the brake that may be needed any instant. On and on they come, more cars, more daredevil rear-riders, a foot on a brake. The wild procession goes off down the winding incline and squeals away through the forest.

"Look out along here. If you hear anything rattle, jump, and yell. Rattlesnakes thick in this mountain misery," cautions the foreman as he minces through the forest carpeting, his little dog alert and at his heels.

You come out into one of the clearings. A donkey engine is bracing itself and panting and choking and pausing, and yielding rope, and fighting it all over again trying to start a distant log at the other end of a thousand feet of steel cable. Then the steady tug continues. A huge log comes snaking along a grooved trail that other logs have cut into

the soft earth. Men attack it as it comes close. They roll it over and into position to be pried on to a car.

A man herding two pack animals comes slowly up. Huge canvas water bags flank the horses' sides and are covered with beady drops. It 's water for the donkey engine.

"Lame again," remarks the foreman. "You know I think that bay gets rheumatism carrying that cold spring water that way. Look how he holds that near forefoot."

You come to a big sugar pine that has been felled and is being cross-cut into sections and split into shakes.

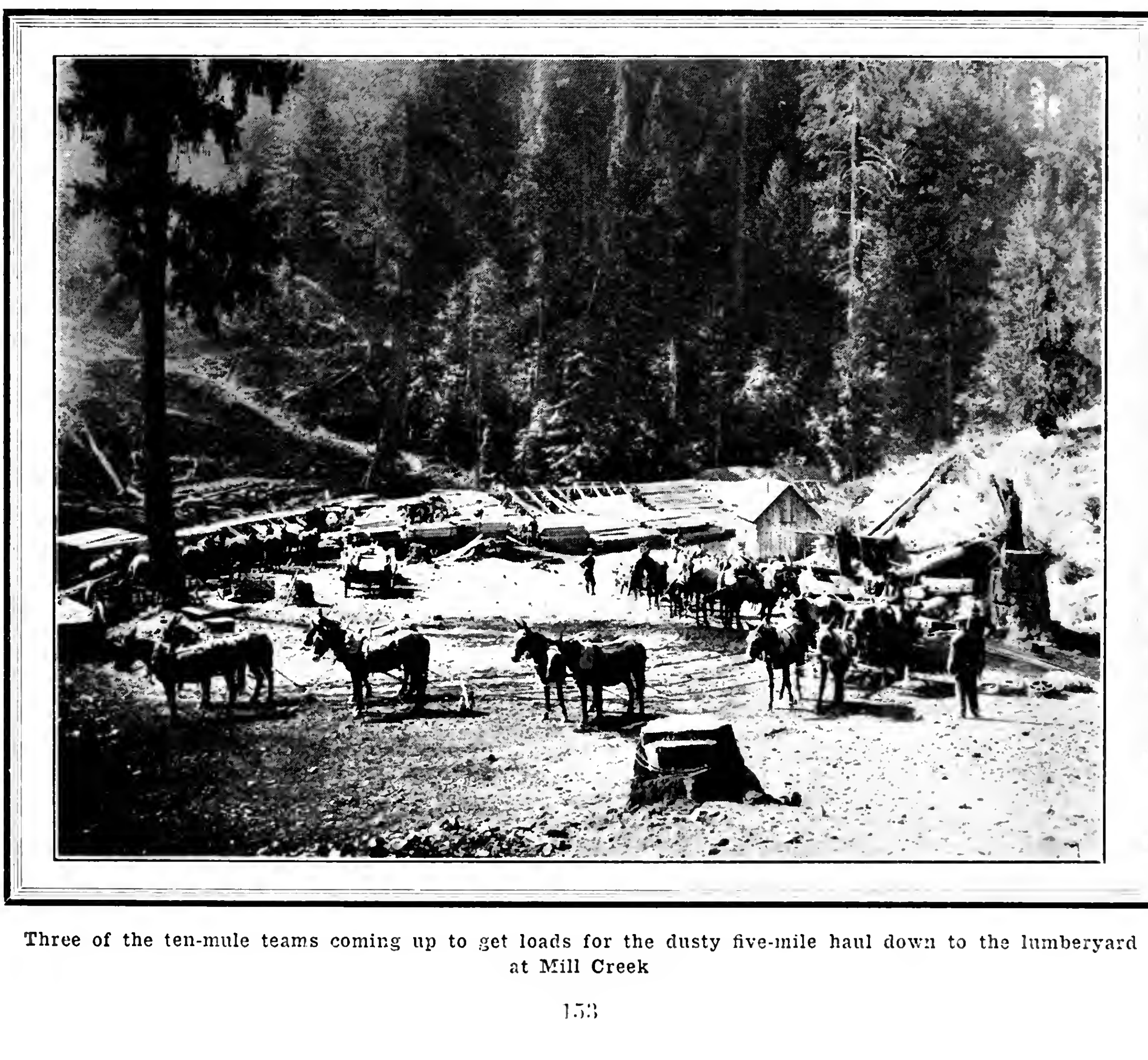
"She 's about four hundred years old," observes the foreman, indicating the rings. You count them, checking off every tenth ring with a pencil. He guessed close. The count shows four hundred and six years.

Then the photographer herds the party against another sugar pine that stands sentinel-like and majestic in a group of yellow pine and cedar.

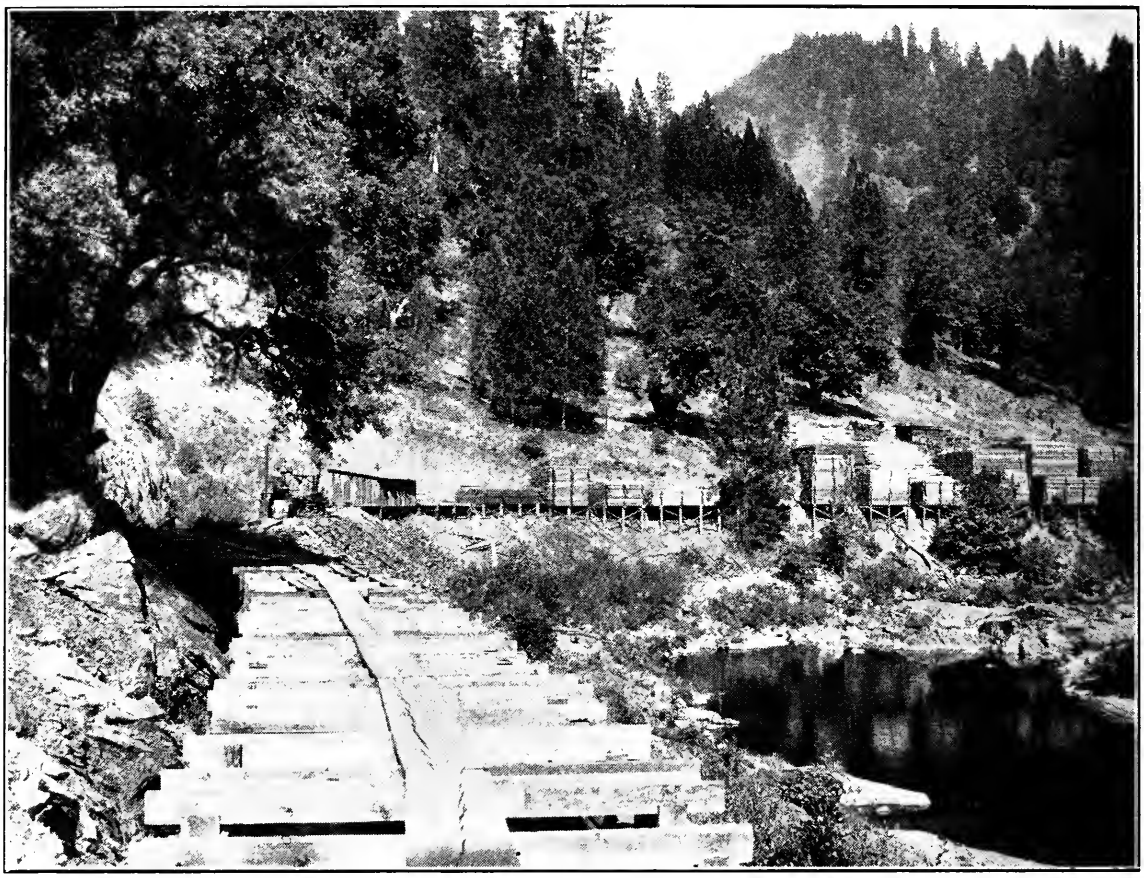
"This one 's just as old, perhaps older," remarks the foreman. "About three hundred feet high, too." Then he runs his tape along round the trunk at the height of a man's waist. "Nineteen feet in circumference. We 'll be over here cutting next week."

Did the superintendent not warn us that it would be dustier than a place of which he knew? He did.

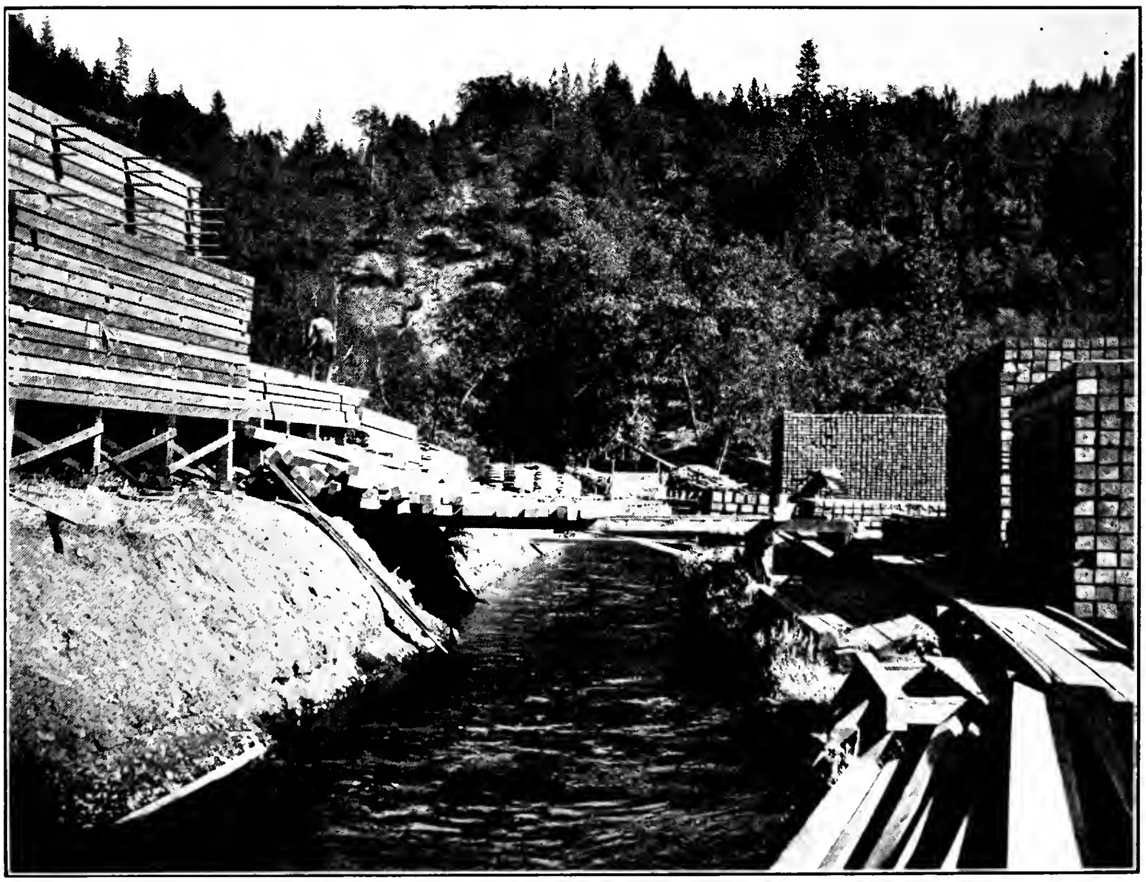
It is not quite five miles down the lumber road to the yard where the canal takes water out of the Mokelumne River. That canal makes a twenty-mile easy gradient round the ridges to the mountain-top above the power house.



Three of the ten-mule teams coming up to get loads for the dusty five-mile haul down to the lumberyard at Mill Creek



The Mill Creek lumber yard on the edge of the Mokelumne River and the Standard Canal that floats the lumber down toward Electra for use along the flume line



In the Mill Creek lumber yard, showing where the lumber is launched into the canal on its way to the various stations along the twenty-mile course to the mountain top above Electra

You follow the lumber teams after they have had more than an hour's start.

There can be no dust in all the world so flour-like, so plentiful, so thick, so hovering and pursuing and caressing as that reddish-yellow covering that powders that road more than ankle deep every foot of those five miles. That ride is a poem in dust. The photographer closes his eyes and grunts at the

A Giant Sugar Pine on the Slopes of the Sierras

jolts into nicely hidden chuckholes. The mules shake their dust-laden heads and constantly whisk their tufted tails, and grope on. You drive, close one eye, then the other, and work on through the impenetrable fog.

After several months of this sort of thing you wonder what season of the year it is. You come out at Mill Creek. There a long line of lumber teams is drawn up to unload.

Again the photographer goes into eclipse under his focusing cloth to produce results that shall make description unnecessary.

You drive on. The mules are tiring. It takes a good deal to tire a mule. They stumble. You hold them up. The brake keeps your right thigh quivering like palsy. On and on you drive, up and down ridges and through the forest. Then into the smouldering belt of forest fire. Again it is dark.

You come out on the mountain top. Down below are those same lights suggesting a prison in the depths between towering ridges.

You blink dust-caked lids and see the thing less distinctly than you did sixteen hours before. You are a symphony in dust, a clay model done in powder. You perch again upon the slivery slab and go gliding threateningly down the mountain toward the bottom of the crater, where the lights are glowing cheerfully. They tell of bathrooms and a good supper. Down there the unequaled Ah Charley is cook.

"How 'd you like to make that trip to Tiger Creek four times a week?" asks the superintendent. "I used to."

The photographer is ready with a very expressive remark. It leaves nothing to be said in any known language.

The People's Water Company, supplying Oakland, Berkeley, and Alameda, has five wells at the town of San Pablo within a radius of fifty yards of a pumping station run by this company's electric energy. The wells are 180 and 200 feet deep, and 319,000 gallons of water are pumped daily for San Pablo, Richmond, and part of Berkeley.

This year's convention of the Illuminating Engineering Society is to be held in Baltimore October 24th and 25th, followed by a course of thirty-six lectures on the subject of illuminating engineering. These lectures will be given at John Hopkins University in Baltimore between October 26th and November 8th to enlighten members of the society and to encourage the establishment of university courses in the subject of illuminating engineering.

The Art of Cooking Hams

By F. J. SOUTHERLAND, Industrial Department.

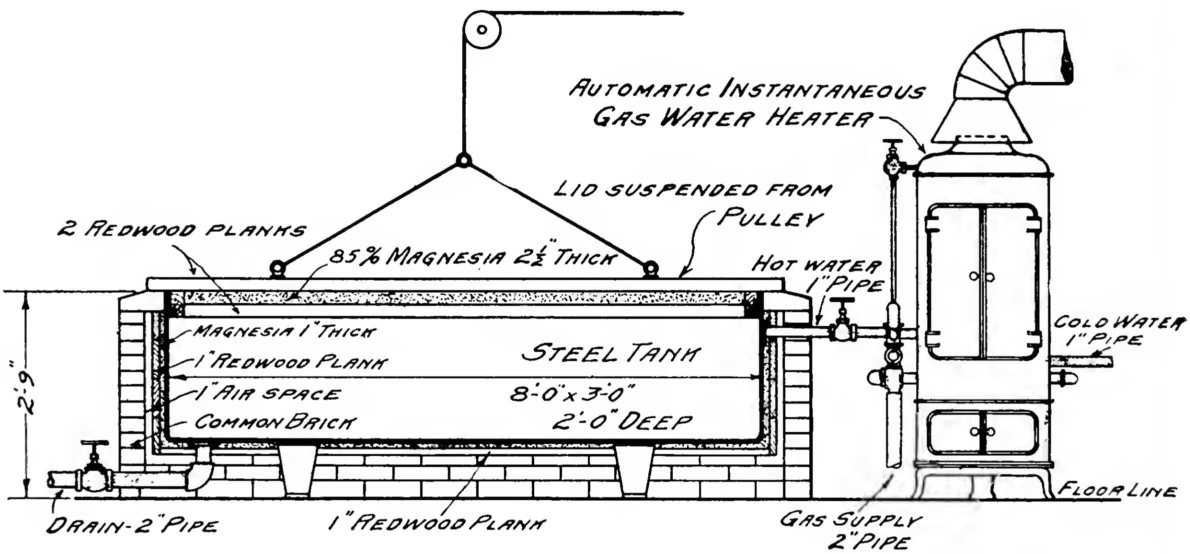
F. J. Southerland

In the good old days when knights and lords of high degree feasted in ancestral castles, sumptous and varied was the repast set before them. In different countries various dishes held first place in popular esteem. But on all tables was to be found somewhere and usually prominent among the viands the succulent smoked and cured ham.

The palates of many demanded that the fragrant and spicy meat should be well boiled, but not so as to spoil the delicious flavor. Accordingly, in great kettles under which fires of logs had been built the hams were cooked. The fire was usually very hot, the caldron bubbled right merrily, and a fragrant odor exhaled therefrom. It is true that when the cooked meat was taken from the kettle it had shrunk in weight a considerable amount and much of the subtle flavor had been lost in the steaming.

But in these days of scientific cooking and the use of thermometers and modern sources of heat a much better result has been attained and at a cost commensurate with the size of the pocketbook of the present-day housekeeper. In large plants are to be found invariably closed tanks, with steam coils or similar means of heating.

It is worthy of remark that with few exceptions, the small plant, and the retail meat shop, where meat is cooked at the rear of the store, still hold to the ancient method of the kettle with the fire under it. The kettles differ in shape and size, and are heated with various fuels, but the method is essentially the same as in the long ago.



CAPACITY 90 HAMS IN 5 HOURS
SECTION THROUGH TANK

One customer of a gas company stopped feeding his fire with wood. He installed a powerful gas burner under the kettle. This worked splendidly until the first month's gas bill arrived. Then the poor economy of such a crude apparatus was at once evident.

Another customer went at the matter in his own plant. He found by experiment that the fireless-cooker principle solved the problem cheaply as to first cost and economically as to operating expenses. It is the object of this article to describe the essential features of

this apparatus, and to emphasize its value, not only to the customer in its prime function, but also to the gas company as a field for the sale of its product.

In this fireless-cooker plant an open tank was constructed and its sides and bottom carefully insulated with layers of magnesia, redwood plank, air space, and on the outside with a course of brick. A removable lid of redwood enclosing a layer of magnesia was arranged to fit over the top of the tank. This vat, from which radiation of heat was almost entirely prevented, is the most important feature of the outfit.

Next in importance comes the automatic, instantaneous, gas water-heater, which supplies water at a temperature of 200 degrees Fahrenheit. It requires 300 cubic feet of gas to cook ninety hams. With gas at $1 a thousand cubic feet this is equivalent to one-third of a cent a ham. Insulated pipes connect the heater and vat.

The hams are boned, bound, and placed each in a perforated steel cylinder, the halves of which are hinged and clamped together. The cylinders are then placed in the vat, which has been filled with hot water at 200 degrees. In half an hour the water has cooled to about 140 degrees, whereupon one-third of the water is withdrawn and a like quantity of fresh hot water run in. This raises the temperature to about 168 degrees, where it stands, without additional heat being supplied, for the remainder of the cooking, or about four and a half hours.

It is claimed that there is achieved by this method from one to one-and-a-half pound less shrinkage in each ham than by any other method. The hams always retain full flavor and are cooked to a uniform and standard degree of tenderness.

Now, it is important to note that this plan can be carried out on as small a scale as desired, merely keeping in mind the essentials of an insulated kettle and an economical supply of clean, hot water. That a gas water-heater both for economy and convenience best supplies hot water for this purpose there can be no doubt.

The proprietor of every retail store within a gas district where hams, corned beef, or other meats are boiled, should have this method explained to him, with the object of securing his fuel business.

Items of Family Expense

IN GERMANY they analyze conditions with infinite care. The government wanted to know the cost of living among the middle classes, the wage-earners and salaried people. Blank forms were distributed in 1907 to a great many families, with the request that they keep a record. This was done for a little more than a year and three months. In this way complete data were secured from 852 families in different localities. Only five of the families had an income exceeding $1,200 a year, or $100 a month. Thirteen families had less than $24 a month.

There were 3,952 people, or an average of 4.64 persons to a family. The average also showed that the principal earnings of the husband formed 82 per cent. of the family income, while other earnings of the husband made up about 2 per cent., the earnings of the wife 2 per cent., the contributions of the children 2 per cent., the subletting of rooms 2 per cent., and the miscellaneous cash income 8 per cent.

Say a family income totaled $100 a month, then these percentages would simply read dollars, the husband getting salary or

wages of $82 and earning $2 on the side, the wife earning $2 a month, the children another $2, a rented room another $2, and miscellaneous sources of income adding $8 more.

Now, let us see where the average of this $100 would go. If the family income were less some of the expenditures would have to be less. But supposing it would reach $100, then, applying the German averages in percentages and making them read American dollars, the list of monthly expenditures would be the following for each family averaging 4.64 persons:

ITEM	EXPENSE
Foods, drinks, etc.	$ 45.55
Clothing, laundry, etc.	12.64
Dwelling (rent or maintenance)	17.96
Heating and lighting	4.07
Health and physical care	2.28
Education, etc.	1.38
Intellectual and social	3.97
Taxes and church	1.43
Insurance and relief funds	3.40
Transportation	1.30
Service and help	.61
Presents, gifts, etc.	.60
Debts and interest	1.40
Trade and business dues	.39
Other cash expenditures	2.16
Expenditures in kind	.07
Savings put aside	1.15
Total	$100.00

The first item, classed as foods, drinks, etc., was found to be made up on the average of the following principal expenses: meat, sausage, fish, suet, etc., $13 a month; butter, $4; cheese, 80 cents; eggs, $1.40; potatoes, $1.50; vegetables, $1.20; salt, spices, and oils, 40 cents; sugar, syrup, and honey, $1.20; flour, rice, etc., $1.30; fruit, $1.30; bread and pastry, $7.40; coffee and coffee substitutes, $1.20; tea, chocolate, coco, 40 cents; milk, $4.60; alcoholic and non-alcoholic drinks at home, $1.50; cigars and tobacco, 90 cents; meals and drinks in restaurants, $2.70. Total, $45.55 a month.

German women are generally good housewives, and might be supposed to do better on the same amount of money than the average American woman. The actual German experience, however, was based on a family income considerably less than this conveniently taken $100 a month. Of the total of 852 families producing the data there were thirteen living on less than $24 a month; 171 families living on from $25 to $32 a month; 234 on from $32 to $46; 190 on from $40 to $50; 103 on from $50 to $60; 102 on from $60 to $80; 34 on from $80 to $100, and 5 on more than $100.

After all, it is the aggregate of little things that make up the running expenses of a family. The small leaks that are not regular take a perceptible amount when the aggregate is a year's record. One thing of special interest is the percentage of family income devoted to heating and lighting; it was 4 per cent. On the basis of the $100 a month family income, that would be $4, or 10 1-3 cents a day. And yet people will habitually complain most against the fuel bill and the gas bill and the electric bill. They are being cheated in an item averaging to the family less than eleven cents a day! But how much attention are they seriously giving to all the other and larger chances of not really getting their money's worth? A. R.

Virginia and Ohio have each furnished six presidents of the United States; New York, three; and Massachusetts, two. The other ten presidents came from different states.

William Henry Harrison was 68 when he was inaugurated, but he lived only a month as the oldest president; Buchanan entered office at 65, Taylor at 64 (lasting a year and four months), John Adams and Jackson at 61; Monroe at 58; four others at 57, one at 56, one at 55, two at 54, two at 53, one at 52, one at 51, one at 50, Polk and Garfield at 49, Pierce at 48, Cleveland at 47, Grant at 46, and Roosevelt (youngest of all) at 42.

Motor Drive *versus* Line Shaft

By H. P. PITTS, Industrial Engineer.

H. P. Pitts

The tendency of modern shop equipment is toward individual motor drive. That is, having a separate motor for each individual machine, driving it either by gear, chain, or belt. There is a question whether all points are considered when deciding between individual or main-shaft drive. It may be that the individual motor, like our modern card index system, is just a little overdone.

Let us consider the line shaft. In the first place ordinarily too little attention is given to this part of the equipment. In the machine-shop the highest priced machine tools are operated by the most skilled machinists. The shafting is in the care usually of a laborer whose duty it is to "oil up" once a week and to let it go at that; he knows nothing about alignment, is apt to pay no attention to the fact that the timbers to which the hangers or bracket boxes have been bolted have become twisted or have shrunk, leaving the nuts loose, and that the shaft becomes out of true, due to these apparently small matters. The overhead shafting should have careful attention, inasmuch as it is sometimes said to utilize thirty per cent. of the power required for the shop. The writer recently in discussing this matter with a well-known shop superintendent in San Francisco was informed that the greatest precaution was taken and care given to minimize the losses in the shafting in his shop, so much so that every morning at eleven o'clock a skilled machinist was employed to go over the line shafting and countershafting thoroughly, taking temperature of bearings and using a pointer gauge against the shaft to determine whether or not it was running true. If anything was found requiring attention it was repaired during the noon hour. This is a very wise precaution and could be instituted by every works where shafting is the driving element. The result is that the starting current on the motor is reduced to a minimum and the piece of apparatus that is supposedly taking thirty per cent. of the power is kept in as good shape as the lathe operated by the most skilled mechanic.

As a rule machine-shops, when shaft-driven, require for their operation less than thirty per cent. of the power at which the individual machine is rated. Therefore, if the machines are classified properly, and the line shaft is cut up into sections, and we will say ten or fifteen machines driven from each, a motor of one-third the capacity of the sum of the full load requirement of each machine will do the work and give a high line-shaft efficiency. This is due to the fact that not one-fifth of the time is a machine taking its full driving capacity, notwithstanding that it may be in operation nine-tenths of the time, for the reason that part of the time is taken to set the piece of work up on the machine, and part of the time in taking finishing cuts, polishing, and so on. Now these fifteen machines are never doing the same operation at the same time, hence the motor has a chance to equalize itself.

Let us consider the individual drive. First of all a machine to be properly equipped should have a motor equal to the capacity of work that the machine will be called upon to do. No other machine is going to help it out. If an overload is thrown on it (and motors are not built these days to carry an overload very long) the motor will drop in speed. In other words, the machine can not do more work than the motor will drive. If a new steel tool be put on the market whereby increased speed may be used (and the machine-shop practice has been revolutionized in this respect in the last ten years) a higher duty

can not be had from this machine on account of the motor.

Second, under these conditions one is compelled to buy fully three times the motor capacity. And that is quite an item at $12 a horsepower. Nothing is to be gained in space; in fact, countershaft-driven machines are more compact as to floor space. Under either condition all tools of the same class will be grouped and as closely as possible.

Modern shops have their wires in conduits in concrete floors. For the individual drive more conduits will be required. Especially is this last feature objectionable in cases where the individual-drive class of machine has to be moved and set up in a different place, and such things are not uncommon. It will never be located just right for the conduit connections. It will mean digging into the concrete and extending the leads. There is another feature of no small importance. A good talking point in this class of motor drive is that the motor is idle when the machine is stopped. But it must not be forgotten that the starting current of these motors runs into two hundred to three hundred per cent. of the operating load. The starting current is going on at a diminishing rate, however, while the motor is accelerating. Shaft-driven machines accelerate much faster. It can not be said to be an argument against shaft-driven machines that they take up room overhead. There is always lots of room overhead; it is the floor space that counts. The cost of belting will not be a much larger item than the gear, link-chain, or belt-drive of the individual drive.

It is not the object of this article to discredit the individual drive (there are places where it is almost indispensable), but to draw out a few points to be considered when a man is almost persuaded to buy three times the motor capacity he really requires.

There are two sides to most questions.

Sherwood Grover, assistant engineer in the gas department, has a son, born September 13th. It is the fourth child—two girls, two boys. He will be named for his dad.

Joe? Why there is Joseph C. Love, the company's chief auditor; Joseph D. Butler, auditor for the San Francisco company; Joseph W. Hall, manager of the Stockton water district; and Joseph P. Baloun, head of the draughting department.

Edward S. Jones, superintendent of the company's gas works at Sacramento, and Miss Allene Brooks were married at Los Angeles Friday, September 23d, during the convention of the Pacific Coast Gas Association. Mr. and Mrs. Jones are making their home at 912 Sixth Street, Sacramento.

Orders have been issued forbiding employees of this company to use matches in locating apparatus in the basements of buildings. Electric flash lights will be furnished for the use of all statement-takers, meter-testers, and other employees.

The employees at the Sacramento gas works, of which Edward S. Jones is superintendent, recently gave him a large gas range and a set of enameled kitchen ware as a wedding present.

At the Sacramento gas works a warm water shower and other conveniences have been installed by Superintendent Ed. S. Jones for the daily cleaning-up process of the workmen.

A Hundred Miles on One Battery Charge

By PAUL R. SHIPLEY, Sacramento District.

Paul R. Shipley

It is easy, when you know how, to get a hundred-mile run out of an electric automobile on one charge of the battery. It can be done with any pleasure vehicle. Proportionately less mileage can be made with a commercial vehicle because of the excess weight of the battery, motor, chassis, wheels, and so on, and the slower gearing. So only about half the mileage can be obtained where so much weight and power are required.

If you treat your pleasure electric as kindly as you would a good horse you can get the century mileage if you will follow the rules here set down. You can even get more than a hundred miles with comfort and pleasure.

The motor on an electric vehicle is simple, and it is fool-proof. Generally it is rated at 200 to 300 per cent. overload, and if the bearings be lubricated with a good oil little or no attention will be required to keep the motor in order. The controller is usually of the drum type and of rigid construction. The wheels and the driving chain require some grease and graphite, according to the weather conditions.

That is about all except as to the cells, and if the following instructions be observed concerning them an electric automobile can be handled by any one.

CHARGING

Never charge cells that are only partly used. Wait until fifty or seventy-five per cent. of the capacity has been used. An old cell that has been cleaned should be given a long charge before being put back with the others. Give the compartments and also the cells all the air possible. Open all circuits, such as lights and bells. Every two weeks or so prolong the charge for one hour after the specific gravity has stopped rising. For an "overnight" charge use about the "finishing" rate of current, as indicated in the table that comes with all vehicles. To bring up an old cell or a bad one always charge at a very low rate and for a long time. Before a cell is exhausted charge it, and if it can not be fully charged at that time give it a partial charge any way; then complete the charge later.

A HURRY CHARGE

It is dangerous to attempt a hurry charge. But it can be started at fifty per cent. above the "start" rate and then discontinued when the voltage reaches "finish," as shown in the table. Then it should be reduced to "start" in the table.

DISCHARGE

Never discharge below 1.70 volts to the cell or 41 volts for a twenty-four-cell battery or 68 volts for a forty-cell battery. Never let cells stand completely discharged.

NEW CELLS

When new cells are first received they should be given a "finishing" charge (in amperes), as indicated in the table, until they gas freely.

PROPORTION OF ACID TO WATER

The electrolyte can nearly always be purchased already mixed. But if not so purchasable then use only distilled water, four and three-fourths parts of it to one part of good sulphuric acid of 1.840 specific gravity. This will give an electrolyte of 1.200 specific gravity. To obtain a specific gravity of 1.275 use three parts of distilled water to one part of acid.

ELECTROLYTE AND SPECIFIC GRAVITY

Readings of specific gravity should be taken every time a charge is made. If water

is to be added to the cells to take the place of that missing through evaporation then it should be added only when beginning to charge. On a full charge the electrolyte should read with the hydrometer 1.270 to 1.280. But it may fall below on charge to 1.250, and from that point it should be restored to the normal specific gravity of 1.275. If the specific gravity fall lower in some cells those cells should be charged separately at a low rate. And if any cell do not then come up to the temperature then add some electrolyte. An old cell that has been cleaned should have electrolyte at 1.200 specific gravity. To get normal specific gravity add water if too high or acid if too low.

One of the Company's little electric runabouts, with A. J. Theiss of the electric distribution department and, in the background, a bit of the Lurline Baths, San Francisco

TEMPERATURE OF CELLS

Never let the temperature of the cells get above 110 degrees Fahrenheit. In charging, if the temperature rise above this mark reduce the charging rate; and if that do not prove effective then stop charging and let the temperature fall. The temperature of a cell or a battery will be very high if there has been overcharging. New cells will have a higher voltage than old ones under the same temperature, and both will read high with the temperature low. The best results will be obtained when the battery temperature is between 70 and 90 degrees Fahrenheit. Normal temperature is 75 degrees Fahrenheit.

GASSING

At starting and finishing periods gassing will be freely seen.

CAPACITY

In renewed or cleaned cells the capacity will not be so great as it was until after they have been charged and discharged several times.

CURRENT

The current should be adjusted according to the table where marked "start," and when the voltage has reached the proper point, as indicated in the table for voltage, the current should be reduced by following the table at "amperes furnished."

VOLTAGE

A fixed voltage can not be considered in determining the end of the charge. But only a maximum voltage can be considered, as the charging is reaching the end. Voltage will read according to the table "volts start" when charging, and as the charge increases it will read according to the table at "volts finished." Voltage should be approximately at 2.55 volts to the cell. Readings of voltage should be taken only on charge or discharge as they are of no avail if taken at any other time.

EVAPORATION

Electrolyte should not be added to bring up the specific gravity. Keep the plates covered half an inch. If they get below, where the plates are not under the solution, add only pure water.

WATER

Add only pure water to the cells after evaporation. But if the cells spill or crack add electrolyte. Water should be added

only at the beginning of the charge so that it may mix with the electrolyte.

ADJUSTING SPECIFIC GRAVITY

If electrolyte have been added to a cell, charge fully, then charge for one hour longer in order to mix the liquids. Never add electrolyte until you have fully determined that the cell can not be brought up to proper specific gravity after the regular charge has been finished.

IN CONCLUSION

Plates will deteriorate very rapidly if left exposed to the air for any short period of time. Always charge in the right direction. Never overcharge or undercharge or discharge to any excessive degree. Never bring a flame light of any kind near the cells, as the escaping gases are very inflammable. Twenty-five per cent. of the life of a battery will be lost if it stand unused for a week.

Electric Talks

II. Magnetism and Magnetic Induction

By JOSEPH P. BALOUN, Head of Draughting Department.


Joseph P. Baloun

A certain force is exerted in one magnet acting on another. This force produces an attraction or a repulsion. It depends on whether the two unlike poles or the two like poles of the magnets are placed together. The magnet attracts iron filings. These results are due to a magnetic or a magnetizing force. The movements of the filings indicated its presence. But the magnetic force can not be seen nor can it be felt with the hand. This magnetic force radiates in all directions from the magnet. But it very naturally decreases as the distance from the magnet increases.

If a magnet be suspended freely and approached with a piece of iron it will move readily toward the piece of iron. Or if we interchange them then the suspended iron will move toward the magnet. This shows the mutual relation of the two, one to the other.

The direction that the force is acting in the space surrounding a magnet is illustrated in Fig. 1. It shows a suspended magnetized steel needle. Move the suspended needle from the centre position, where it lies parallel to the magnet, toward either end of the magnet. It will then be noticed that the north and south poles of the needle will be deflected toward or away from the north and south poles of the magnet according to whether the like or the unlike ends or poles of the needle and magnet are brought nearer to each other. Thus the dipping needle is deflected gradually at an increasing angle toward the poles of the magnet until it finally takes an angle or position of ninety degrees to what it originally had at the centre of the magnet. In a similar manner if we pass the ends of the bar we still notice the unlike ends of the magnetized needle and magnet nearest to each other. Thus we know that the space for a considerable distance about a magnet is effected by the influence of this force. This space which is under the influence of this magnetizing force about any magnet is called the magnetic field.

It is impossible to have a magnet with only one pole or with no poles. Because either iron or steel is a conducting medium for magnetism its cross sectional area influenced by

the lines of magnetic force is very much less than the area affected through the neighboring air space. Since the concentration of the magnetic force produces no effects such as attraction or repulsion at the centre of a bar magnet it has been assumed that these magnetic lines of force leave the N, or north end, and re-enter the S, or south end, of a given magnet.

If an iron ring, as in Fig. 2, have a section cut out therefrom and be magnetized, lines of force will flow around the ring and follow a path as shown. This force jumps across the gap. It is this leaving the one end and entering the other that makes the two poles. If this were a solid ring there would be no attraction for iron, and it would not be a magnet.

Convenient mathematical discussion and data for this force or these so-called lines of magnetic force in the magnetic field will be considered in succeeding papers of this series.

A picturesque representation of the lines of force in the magnetic field surrounding a magnet can be produced by laying a bar magnet flat on a table and then covering it with a piece of heavy paper. If fine sifted iron filings be carefully sprinkled from a gauze onto the paper over the magnet and in the meantime the sheet of paper be very gently tapped the filings, being affected by the magnetic influence, will gradually arrange themselves along the lines of force eminating from the poles of the magnet and influencing the surrounding space as shown diagrammatically in Fig. 3. If it be desired to make a permanent record of this magnetic field paraffin-coated paper may be substituted for the ordinary paper. Then when the field is outlined and produced thereon, the paper may be carefully heated over a flame. The heat will soften the paraffin, and when the paraffin cools again the filings will have been fixed to the paper and a pretty, symmetrical design obtained.

A large number of very interesting experiments may be carried out along the foregoing lines by using a single end of a bar magnet, or the double pole of a horseshoe magnet, or two bar magnets in parallel or at right angles, or an increased number of magnets arranged under different conditions. Another suggestion here would be to try first two parallel magnets with the like poles adjacent, and then again with the unlike poles adjacent to show most conclusively the repulsion between like poles and the attraction between unlike poles.

One of the simplest and neatest experiments to illustrate the internal change of a body before and after magnetization is to take a glass test-tube and fill it with very coarse iron filings and then cork both ends. It will then be the same as any iron bar before being magnetized, and will appear when filled as shown in Fig. 4. Let this tube of filings be now magnetized by any of the methods employed in making an artificial bar magnet. It will be found upon examination of the tube that where in Fig. 4 the filings were indiscriminately arranged now the result, indicated in Fig. 5, will show all the filings under a magnetic influence with symmetrical positions and each individual grain of iron to have its north end or pole lying next to a neighbor with its south end or pole. Thus this tube of filings represented by Fig. 5 has attained somewhat the characteristics of a magnetized steel bar. A severe shake of the tube will destroy the positions of the grains and make them intermingle, and the tube will by that sudden disturbance become demagnetized.

In support of this theory of magnetism, if a long steel magnet be broken into a number of pieces, as in Fig. 6, and if each piece be tested for its north and south poles it will be found that at each break a new north and a new south pole has been formed, thus showing that a magnet is an aggregation of small magnets arranged as shown on a magnified scale in Fig. 7.

Though this internal arrangement of matter can not be seen in magnetizing a piece of steel for a magnet, these experiments show what

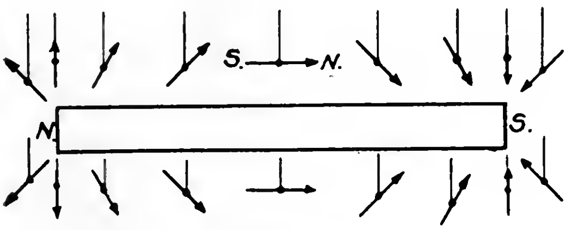


Fig. 1

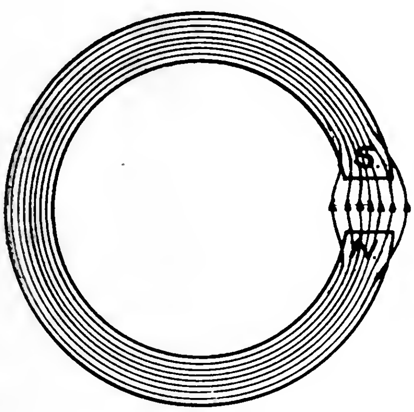


Fig. 2

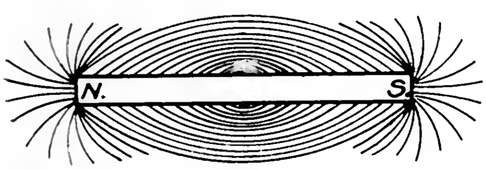


Fig. 3


Fig. 4

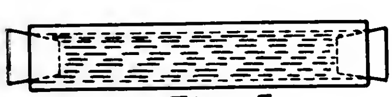


Fig 5

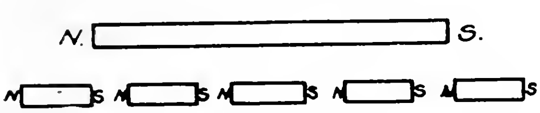


Fig. 6

Fig. 7

probably takes place during the magnetizing process.

A piece of steel is capable of taking only a certain amount or degree of magnetism. No matter how strong the magnetic force may be the bar will not absorb beyond a point called its magnetic saturation.

It is very interesting to see the magnetic difference between a steel bar inserted in a coil of wire through which a current of electricity is flowing and then substituting a soft wrought-iron bar of the same dimensions. The attractive power of the soft iron will be much greater while the current is on, but when the current is off the hard steel will be found to possess superior attractive qualities. This shows that the permanent magnet is no small feature in certain electrical measuring instruments. The continued accuracy of these instruments is so important that the absolute permanency of its magnets is the only solution. If a magnet become weaker naturally serious errors will result. For this reason all reliable manufacturers use the best grade of magnet steel and harden it by their special processes so as to render the magnets permanent for a long period of usage and to retain what is called residual magnetism, as this is a most important factor in operating dynamos or generators, because their self-exciting properties depend so much on their residual magnetism.

All magnets have a certain so-called lifting power. This depends upon the strength of the magnet, the shape of the poles, and upon the form and material of the body to be lifted. A small magnet will lift more in proportion to its weight than a large one. A horseshoe magnet will lift four times as much as a bar magnet of the same weight. Chamfered edges on the faces of the poles materially improve the magnet's strength.

A curious phenomenon is connected with the ordinary type of horseshoe magnet. If a very small weight be added daily to the original it will be found to attract considerably more than would have been possible if the final weight were originally attempted. But if a certain maximum be exceeded so as to allow the entire collection of weights to

fall, then the magnet's strength will return to its original value.

By using electro magnets a lifting power of several hundred pounds the square inch of the pole's surface can be secured, as is shown in the modern traveling magnetic lift crane for use in the steel, nail, bolt, and plate mills and yards and similar industrial concerns.

A piece of soft iron placed in the magnetic field of a magnet becomes itself a temporary magnet with two poles and a neutral point. This temporary magnet is then said to have obtained its magnetism by induction. The magnet is the inducing body, and the action of the influence from one to the other is known as magnetic induction. If a sheet of paper, lead, copper, or glass be inserted between the magnet and the soft iron bar it will be noticed that filings will be attracted to the same degree as before these foreign materials were interposed. Thus magnetic induction takes place when a body is in contact with or separate from the magnet. The attraction of a magnet will be exerted through all non-magnetic media whether they be solids, liquids, or gases. Each individual iron filing becomes a magnet by induction before it is attracted. Then after attraction it acts on the adjoining filings inductively, and so on. The pole of a magnet induces an unlike pole in the end of the steel or iron nearer to it and a like pole at the other end. The two unlike poles attract each other. The preceding descriptions for making magnets are based on the principle of magnetic induction. In all cases of magnetic induction the action and reaction are equal and opposite.

If two magnets be placed with their like poles together they will not have the lifting power of twice a single magnet, for though they act in unison in attracting a body they are in a measure also opposing each other.

(To be continued.)

Three thousand electric automobiles are in use in Chicago.

Cover a fresh burn or scald with cooking soda and lay a wet cloth over it. Or apply white of egg mixed with olive oil; or put on olive oil or linseed oil.

The North Star Mine near Grass Valley, to which the Pacific Gas and Electric Company supplies electric energy, the mine that has produced $30,000,000 in gold, is down 5,400 feet diagonally, or more than a mile, on the auriferous vein and has penetrated the earth to a depth of 2,150 feet; and it is still going down.

On the county road between Newcastle and Auburn there is a white house with a history. When its owner was excavating for its foundations he uncovered $6,000 in cash. Some one had hidden it there years before. The find more than paid for the new house and barn.

There is an inscription at Lake Arthur, the company's newest lake, situated above Auburn in Placer County, announcing "Altitude 1,493.68 feet."

The largest water-wheel in the world is at the North Star Mine, near Grass Valley, California. It measures thirty-four feet in diameter, receives water from this company's pipe-line, and runs the condensers that send air down into the lower levels of the great mine itself, which is regularly producing $120,000 in gold every month.

Leach President Gas Association

By HENRY BOSTWICK, Secretary, Executive Offices.

Henry Bostwick

Oakland is to be the place of next year's convention of the Pacific Coast Gas Association, in September, 1911. And Frank A. Leach, Jr., manager of the company's Oakland Gas Light and Heat Company and of its Berkeley Electric Lighting Company, is the new president of the association.

It was a great time the hundred and fifty of us had at the Los Angeles convention September 20th and the days that followed. Those who had attended all or most of the seventeen preceding annual sessions said it was the best yet.

Two days were devoted to papers and regular business. The rest of the time and the evenings were crowded full of fun and sight-seeing and sociability.

Frank A. Leach, Jr.

At the skating rink nineteen manufacturing companies from different parts of the country combined in an instructive exhibit of gas appliances—everything from instantaneous water-heaters to gas stoves.

Since the Pacific Gas and Electric Company supplies gas to thirty-three California communities and operates eighteen gas works, one of them the largest in the western part of America, it was to be expected that her membership would figure somewhat in the programme. It did. More than half of the papers were by men of this company. And when it came to the election of officers favors seemed to flock to the men with the company's blue and silver emblems. See who were elected; stars indicating men of this company.

POSITION	NAME	CITY
President	*Frank A. Leach, Jr.	Oakland
Vice-president	William Baurhyte	Los Angeles
Secretary and Treasurer	*John A. Britton	San Francisco
Asst. Secretary and Treasurer	*Henry Bostwick	San Francisco
Director	H. E. Adams	Stockton
Director	H. W. Burkhart	Los Angeles
Director	*E. C. Jones	San Francisco
Director	Joseph M. Berkley	Los Angeles
Wrinkle Editor	F. C. Millard	Los Angeles
Experience Editor	*John A. Kuster	San Jose
Novelty Editor	*John Clements	Berkeley
Librarian	*E. C. Jones	San Francisco
Committee on Gas Engineer's Degree	*E. C. Jones	San Francisco
	L. P. Lowe	San Francisco
	*John A. Britton	San Francisco
Advisory Board	*Sherwood Grover	Oakland
	W. J. Dorr	Los Angeles
	*Frank Foveaux	Alameda

Those of the company who may wish to prepare papers for next year's convention should bear in mind that every cooperative effort will help to make the meeting a success, reflecting credit upon Frank Leach as the president and practically the local host of the assemblage. Also it will redound to the credit of the company.

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EDITORIAL

What Creates Brain Power?

There is untold water-power in fog. If the great gray bank that comes crowding in over San Francisco could somehow be condensed, the fall of water would produce all the power needed to light the city and operate its industries and machinery.

So a scientist says. Nor is it beyond the range of possibility.

What if some one twenty years ago had declared that the snows of the Sierras contained water-power that could be made to light the distant seacoast cities of California? But the thing has been done. The Pacific Gas and Electric Company's Electra power plant is doing it.

The world is full of possibilities undeveloped.

In the human brain there are sixty million tiny cells. Each cell is a storage battery.

Thinking, reading, studying, observing, discussing various subjects, keeping a clear head—that is the process by which more and more of the cells become charged, by which they store away information.

Accurate thinking gets the ideas definitely classified. They go into the right compartments. When they are wanted again trained thought readily recalls them.

A person with a brain so charged is said to have knowledge, learning.

Seeing and living over the same narrow existence day after day, using the same limited vocabulary, cheating the nerves and the mind with liquor—that sort of thing uses and injures just a certain few cells. All the others are lying idle, vacant, undeveloped.

Such a brain is like an orange with juice in half a dozen globules and the hundreds of others flat and empty. But the brain's cells run into tens of millions.

Take the human lungs. They are just a great pulpy mass of thousands of air cells.

The flat-chested, aenemic individual has weak lungs. Why? Only a comparatively small number of the air cells have been inflated. The others are flat and empty. All the blood-purifying work has to be done by those few cells. The process makes for languor.

It is like trying to run an electric automobile with most of the storage batteries empty.

Muscle is only an expansion of tissue cells. Physical strength consists in making the most of the tissue cells.

Most life insurance companies refuse to take liquor dealers. Experts who compile the causes of death, with ages and all attendant conditions, have shown conclusively what to expect. They know rules, deduced from hundreds of thousands of cases.

Sentiment cuts no figure. A company takes the chances of paying out $10,000 in cash tomorrow for $100 received today. Statistics show exactly the chances taken when applied to many cases.

They figure against alcohol because in the majority of cases the effect is to cause liver and kidney trouble. They fear diabetes. It may develop tomorrow or later. But if the man use much alcohol there is always the prospect.

The liver is a strainer. It can handle only so much alcohol a day. If more comes it clogs.

The amount of alcohol that can be taken in safety is only one tiny glass of whiskey a

day for the average person in the average climate.

An automobile is propelled by the explosive force of gasoline "shooting" in sequence in little cylinders of the engine. When some cylinders do n't "shoot" the machine is not getting its full power.

When the human brain is getting along with a few cells, and has millions flat and empty, the individual is stupid, or limited to a few ideas. He is not getting out of his brain cells what he could. His mental force is neglected or degenerated into some sluggish channel. So we have a world of incapables, of men less than they could have been, than they could be.

A Day at Camp Taylor

By EUGENE A. BEAUCE, Bookkeeping Department.


Eugene A. Beauce

The Gaselco Social Club had its first annual barbecue at Camp Taylor September 5th, Labor Day. The members of the club and their friends to the number of two hundred, forgetting all about "D. R. meters", "dropped credits", "unpaid balances", "back bills", "discontinued notices", "shut-offs", "overtakes", "missing statements", and like trouble-producers, left San Francisco on the 9:15 boat and from Sausalito were conveyed to the grounds in a special train. An ideal day greeted the pleasure-seekers on their arrival at Camp Taylor. The change from the fog-laden belt about San Francisco Bay was a source of genuine pleasure. The barbecue itself, which had been generously provided by the company, was attended to by master hands under the able superintendency of D. Augustus White, president of the club, assisted by Larry Walsh and Frank E. Oldis as chief carvers, dressed up like real chefs.

Three hundred pounds of lamb and fifty pounds of beef were roasted over a wood and coke fire in a big trench. At one o'clock the meats and other accessories, both solid and liquid, were ready for the onslaughts of the hungry hundreds.

Gus White, clad in a make-up that caused one young woman to liken him to Dunstan Farnum as "The Virginian", gave the order to "fall to".

The guests were seated at three long tables under the shade of mighty redwoods. Appetites, sharpened by the trip, responded generously to White's injunction. Chefs Oldis and Walsh had as assistants S. J. Lisberger, Frank Mogan, Billy Driscoll, Jack Judge, Will Cavanaugh, and Johnny Cunningham, who acted as waiters. These saw to it that everybody was well supplied with all kinds of good things. Jack Hyland and Charlie Butler improvised a refreshment booth and dispensed beverages, both mineral and malt, throughout the day. Jack's cheery "just a minute, please" was the magnet that proved highly attractive in drawing many thirsty patrons to his place of business.

One little miss of seven who was munching a succulent piece of lamb said to her mother between munches, as she followed the movements of the volunteer waiters in their

white coats: "Mama, I know now why they call this a barbecue; it 's because there are so many barbers".

"All things come to him who waits" soliloquized Will Cavanaugh, who has been in a soliloquizing mood of late, "but I have been waiting here for two hours and nothing has come my way yet".

Sure enough it was a labor of love with the amateur waiters. The only tip in evidence was when Jack Judge tipped a cup of hot coffee right into the lap of a handsome brunette. "That waiter misunderstood me", said she, as she good-naturedly mopped up the fragrant mocha. "I ordered *cafe au lait* not *cafe au lap*". Will Laughlin, one of the deans of the faculty of collectors, who thinks water is an excellent thing—to bathe in, said, as "Lizzie" Lisberger placed a bottle of mineral water at his plate: "Say, is that water fresh"?

"I do n't know", replied "Lizzie", "it has n't said a thing to me".

"This meat is certainly done to a turn" said John Donovan as he started in on his third helping.

"One good turn deserves another" answered Bob "Ironsides" Bowman: "let 's have another".

"Coming in just a minute" said "Johnny-on-the-spot" Hyland, who overheard the remark, and was keenly alive to the liquid requirements of his guests.

"There is certainly class to this" said Will Dawson, who moralizes occasionally. "At most picnics you have to bring your own 'eats', but here it is one big, glorious 'hand-out', and costs nothing. They ought to have one of these every month."

When a goat appeared upon the scene Frank Mogan created merriment by crying out "Pass the Butter". But no one cared to undertake the job.

After justice had been done to the feast the assemblage adjourned to the dancing pavilion, with the single exception of "Count" Boris Kuechen. He was attired in a golf costume of the latest approved English pattern. Regretting only that he had left his golf sticks at home, "do n't you know", he started on a cross-country run and was seen no more until the train started homeward.

Bob Thorpe, who proved himself the life of the party, put a lot of younger men to shame by dancing with nearly every woman on the grounds, not overlooking his good wife and charming daughter, "Sophie." And then, to rub it in, Bob challenged any one to dance a Marathon for any amount from "$1 minimum" up, with no takers. Dick Courtier, who had walked up the cañon to take a look at initials he had carved years before, heard the challenge, turned, hesitated, but walked on up the cañon, and carved his initials once more, thus making a name for himself!

Johnny Cunningham, to show how fond he is of children, wheeled a bevy of happy youngsters in a cart all round the grounds, until he had to stop from sheer exhaustion.

After a day filled with care-free enjoyment, the merry-makers boarded the return train for home, and they were unanimous in the declaration that the first barbecue of the Gaselco Social Club left nothing to be desired. It was a success from start to finish. In all likelihood when those who did not go hear all about what they missed from those who did go, it will take two trains instead of one to transport the crowd to next year's outing.

The Hercules Water Company, owned by the Du Pont de Nemours Powder Company, has a pumping plant near San Pablo pumping from three wells within a radius of one hundred yards. The deepest well is down 365 feet. The plant was started to supply soft water for use in the Babcock boilers at the dynamite works at Hercules, five miles away. Electric power is used, and the Pacific Gas and Electric Company supplies it.

Building New Substations

By C. F. ADAMS, Engineer Electrical Construction.


C. F. Adams

When electrical transmission lines were first drawn across the Sacramento Valley several small steam-driven power plants were connected to the new system as the first large consumers. Practically no change was made in these former steam plants, as the owners wished to remain in condition to operate with steam power if necessary. The transformers for the new high-tension service were often placed on the engineroom floor and connected to the bus bars of the station switchboard. The transformer bank would be protected by some form of fuse switch or disconnecting switch on the high-tension side.

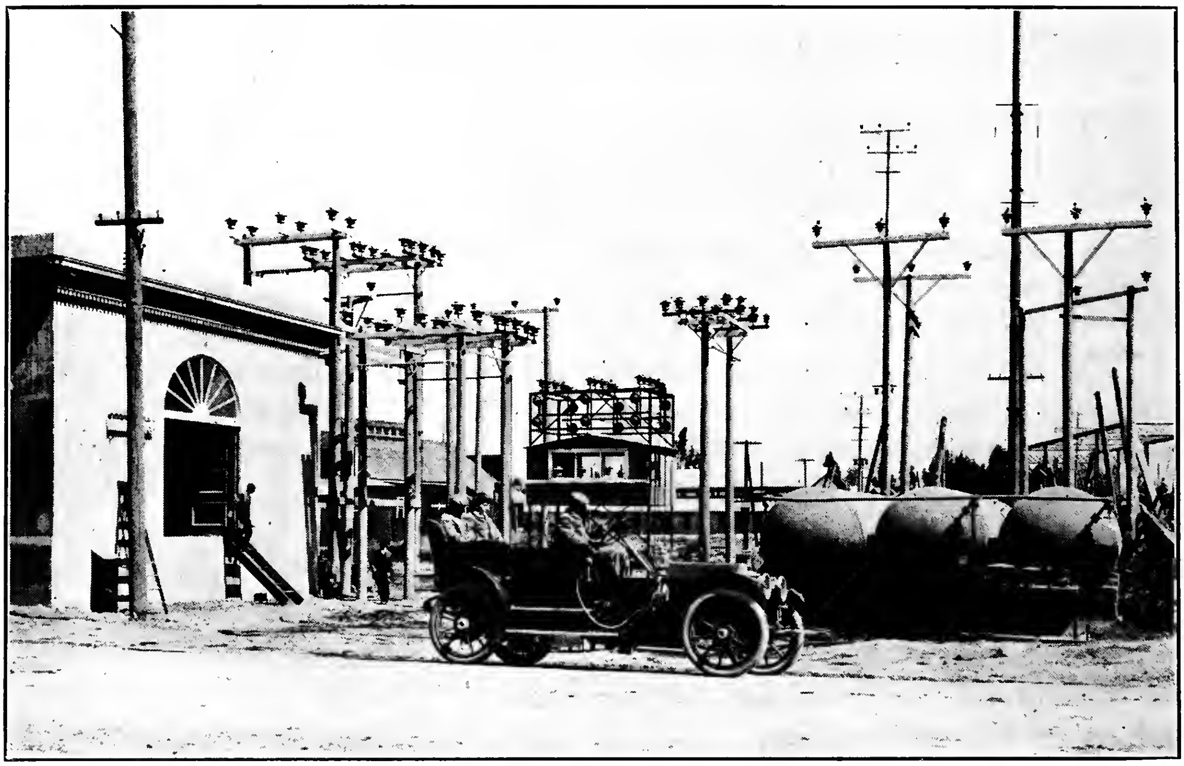
In some of the smaller communities, at new stations, a single transformer would be connected to the lighting circuits with no instrument equipment except a voltmeter. The service was new. The power development had taken much more time and money than had been estimated. When the final distributing centres were placed in service they were often of primitive character. This type of construction served its day admirably. True, there were accidents, "blow outs," failures of insulation, and questions of voltage control that required much attention.

Managers of small systems that had got along easily with a 50- or a 100-horsepower steam plant had to learn many new things after being connected to lines with large power capacity.

The experimental period of transmission was soon passed. An easy-going though progressive people soon comprehended the value of a dependable power service rendered at a low cost.

Applied to mining, manufactures, agriculture, or transportation, the result of this service has been growth and advancement. In

San Rafael Substation, near B Street Station, southeast end of town



The Petaluma Substation, showing the open-air switches (also J. P. Baloun on back seat of auto)

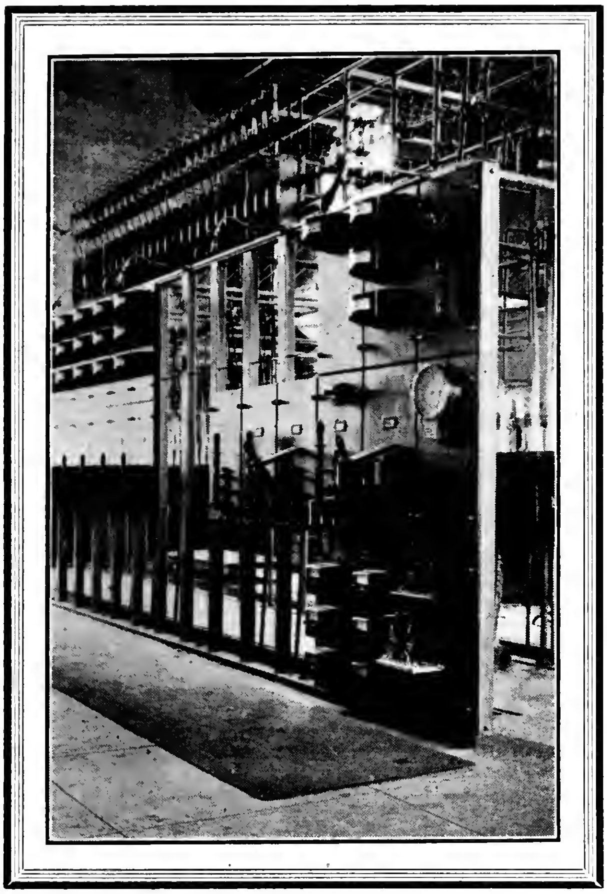
time, as population and business reached new figures, the old substations began to be objects of much concern.

Electrically they were outgrown. Mechanically and as a fire risk they were hazardous. Their replacement became a necessity.

For the past four years these old-type stations have been gradually superceded by a new and permanent type of structure. The purpose of this article is to illustrate these new substation developments. As this company owns and operates more than two hundred substations as distributing points for its fourteen big electrical generating plants the reconstruction of substations is something of an item. As fire is the chief destroyer of substation properties all new substations were built with the lowest possible fire risk. Concrete has been largely employed on account of its stability as well as its fire-resisting qualities.

Petaluma switchboard

The station at San Rafael had become the centre of a large and growing urban business. The pleasant valleys and sunny hillsides of Marin County were being rapidly peopled. Longer lines, heavier loads, an increasing number of feeders, all pointed to a time when a radical increase in capacity would be necessary, and perhaps a higher voltage needed on the longer feeders. The new station was laid out for an increase in transformer



San Rafael switchboard

capacity, and with space for high-voltage, concrete, switch cells. There was also ample room for feeder regulators and for switchboard space for future business.

All wiring was supported on metallic frames, and each circuit was provided with switching and control facilities.

The building was of reinforced concrete construction, the foundations being carried down to permanent sand. The old substation was made over into a general warehouse, in charge of the station operator.

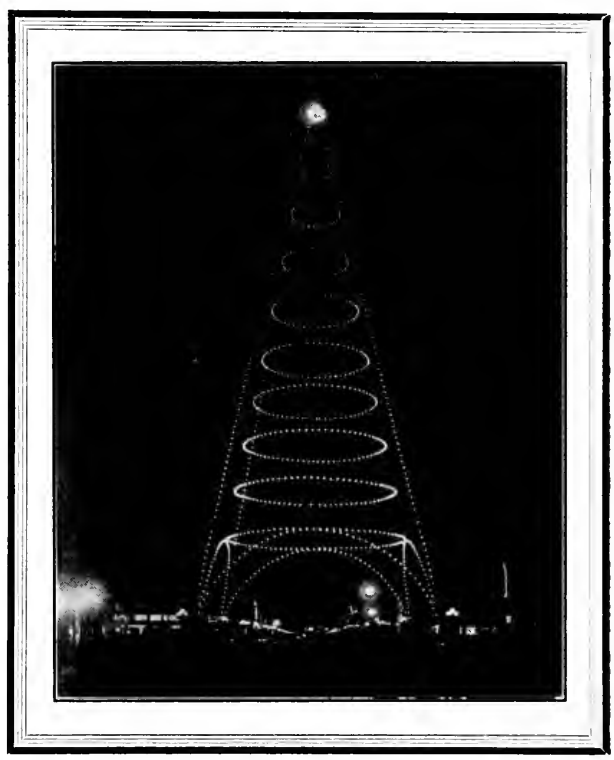
An illustration from a photograph shows the detail of the completed work. The building was constructed under the direction of H. C. Vensano, now the company's civil engineer.

The electrical work was personally supervised by D. W. Rathbun. The station grounds will be filled in and decorated under the eye of the local manager, W. H. Foster.

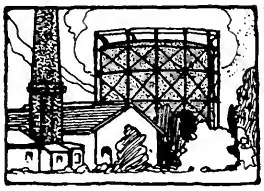
While the San Rafael substation was being built similar work was in progress at Petaluma. There a new location for a station was chosen, nearer the business centre. The old station building, well adapted for refrigerator business, was sold to a local refrigerator company.

A modern switchboard, increased high-tension switching equipment, and new distribution lines were constructed. This building is also of reinforced concrete, and has a structural steel frame. The electrical work was in charge of M. P. Werry.

Up in Crane Valley in Madera County the San Joaquin Light and Power Company has six hundred men at work on a great dam that is to be done next spring. Across the crest this dam will measure 843 feet, and it will be 143 feet high. The construction consists of a concrete core and a rock fill. The impounding area is to hold 55,000 acre-feet of water.



The well-known landmark tower in San Jose, aglow with electricity supplied by this company. It is customary so to illuminate it during local celebrations.



MEN OF THE COMPANY

LEE HAMILTON NEWBERT

Who has grown with the system eleven years and advanced to manager in the peninsular towns

IT was the last day of January, 1878. Great monitors were shooting their powerful streams into the gravel beds. Gold ground was being dissolved by torrential jets of water and sluiced off to catch the tiny particles of the yellow metal. Mining was the chief business of the community. Three thousand people dwelt in Smartsville in those days. The town was in its prime. Hidden among the foothills of Yuba County, it was a little world unto itself. The Yuba River flowed by marking the seasons with much or little water from the distant Sierras to add to the volume of the Sacramento down at Marysville, in the flat country, a score of miles away.

Hear the news? Lee Newbert has a boy!

A birth has always been a social event in Smartsville. But that was more than thirty-two years ago.

What became of the boy?

There are no streets or public libraries or drinking fountains in Smartsville named for him. Smartsville has no streets. The stage road comes down out of the mountains, from Grass Valley and Nevada City, and strays through what is left of the town. No children there are christened in honor of any famous son of Smartsville. Probably because children are scarce in a place that has dwindled to two hundred souls and half-soles. So pa 's first name still has the call when any body reports the arrival of a son.

But Smartsville is on the verge of a mining revival. A novel way of working hydraulic diggings without obstructing the river channels is being perfected for use right there at the old stand. A real estate boom may strike that town any day now! Perhaps some one will promote an "old-home week" to get the stragglers back, to buy town lots after all these years. And who would most fittingly grace the speakers' platform as "president of the day" the date of the big doings?

Sh! Do 'nt say the name. Let it seem spontaneous and go through by acclimation when the great mass meeting assembles in the grocery store.

Probably in all its existence, since the earliest mining days of more than half a century ago, Smartsville has never seen a Tuxedo. So far as the experience of that town goes Tuxedo may be a breakfast food. It will be hard for the old-timers to grasp the idea of a dinner coat, and dinner at night. The oldest timers used to go without a coat at noonday dinner, because the sun has ever poured its bounty of sizzling heat down into Smartsville in the good old summertime.

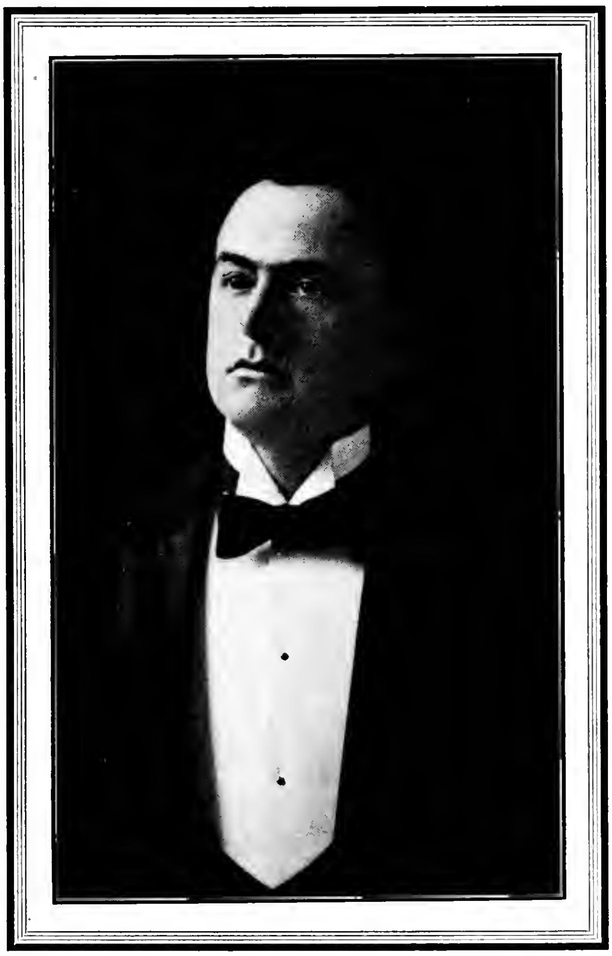
But if Smartsville is to boom and become a metropolis it must get used to the Tuxedo. Who can teach the trick?

That little boy born there nearly thirty-three years ago went forth with the exodus, when hydraulic mining was discouraged by law. At sixteen he was graduated from the grammar school at Marysville. Then he went to work in the Marysville Canning Company; then for the Cass News Agency; and then the lure of the law caught him, and

thoughts of oratory and of impassioned appeals to a drowsy jury held him hoping away the days as clerk in the law office of Richard Belcher at Marysville. So he came up to the age of twenty-two.

Being a Daniel Webster or a Henry Clay might have been all right in the east and in another generation. But Marysville did n't seem to be the field for development of western talent. Oratory was fine in its place, but the more practical consideration just then was ready money.

The Marysville Gas and Electric Company would take on a meter-reader and collector, no knowledge of the law necessary! Blackstone was shelved for a smaller book, and the name Lee Hamilton Newbert, went on to the company's payroll. It stayed there for pracitcally a year and a half. Then the young collecter was advanced to the title of assistant manager of the company. He had not served quite five months before Promotion picked him out again.



Lee H. Newbert

He was transferred up to Nevada City as the local manager there of the Nevada County Gas and Electric Company. He spent four months at Nevada City. Then Promotion beckoned him back down into the great valley to be manager at Marysville. He put in three years and seven months without being forced to move on to yet another and better position.

But Promotion had tagged him for her own. When he was twenty-eight she came again and led him down to the San Francisco peninsula to take the management at Redwood of the Pacific Gas and Electric Company's business in all the district between San Francisco and San Jose. There he has been these last four years.

While he was manager at Marysville, and twenty-five, he married. Now he has a little daughter aged four.

At Redwood City the name L. H. Newbert means two things: the gas and electric company's local head and the exalted ruler of the lodge of Elks.

Lee H. Newbert is a mixer. He gets into the social play. He does the black-face comedian stunt. And to him a Tuxedo comes just as naturally now as though he had never seen Smartsville.

At this year's convention of the Pacific Coast Gas Association in Los Angeles he presented one of the important papers. Suburban Gas Distribution was the subject treated. Being an Elk and rated a good fellow, gas distribution was not the only thing treated.

A. R.

If you have a bottle of gasoline for cleaning purposes be sure and keep it on a shelf outside the house. Any escaping fumes are always a menace if there be an open flame within several feet of the bottle.

The Prevention of Accidents

By JOHN P. COGHLAN, Manager Claims Department.

John P. Coghlan

The introduction of machinery brought many new risks and hazards into all modern employments. The tendency at first was to consider the additional accidents that followed new appliances as mere incidents to the improved methods and increased production. But time proved such a view to be false. It showed that while every effort was made to make more and better machinery, little or nothing was done to insure safety in operation. Moreover, it was demonstrated that additional accidents meant an extra outlay of capital in repairs and in damages for killed and injured workmen. Often it meant a loss in production, in that each accident affected the temper and spirit of the workmen, and thus reduced their interest and efficiency.

When these conditions had become manifest employers in many industries set about to correct them. At first the effort was to prevent a repetition of accidents that had already occurred. To that end faults and defects that had produced injury were corrected and repaired. In other words, accidents had to occur before defects were seen and remedied.

But eventually it was found that accidents could be foreseen. This discovery naturally led to a study of operating conditions and finally to a detailed inspection intended to prevent accidents. Wherever inspection was taken up systematically it soon developed into well-organized safety departments. Today many industrial corporations maintain safety superintendents equal in rank to other heads of departments. These safety superintendents generally head an organized office force and a corps of trained inspectors. Usually their inspectors are experts in the operation of machinery and oftentimes in complicated methods of manufacture. Not infrequently they are specialists in the manufacture and operation of one particular class of machinery.

These inspectors devote all their time to studying the causes of accidents and the means of preventing them. They carry on a detailed inspection, reporting every defect. Often they report to their superintendent daily, frequently illustrating their work with photographs. In their reports they embody suggestions from foremen and superintendents, and frequently from workmen. And in all cases they supplement their report with recommendations showing how and where defects in operation may be remedied.

In some corporations the recommendations of such inspectors are submitted by the safety superintendent to a board, or committee. Usually this board, or committee, consists of the superintendent himself and two or four of his assistants. Sometimes it is composed of the superintendent, the casualty manager, and an engineer.

In many corporations every accident is investigated by a committee specially appointed for that purpose. Oftentimes the committee is composed of foremen and superintendents; at other times of workmen taken from the department in which the accident under investigation occurred. In every instance the committee is authorized to make a complete investigation and to report how to avoid like accidents. Wherever a corporation has had the foresight to appoint either of these committees it usually has been progressive enough to adopt the recommendations submitted to it.

The United States Steel Corporation has, since April 1st, 1908, maintained a permanent committee on the prevention of accidents. This committee is composed of five members selected from the most prominent casualty managers of the constituent companies. It employs a full corps of inspectors and con-

siders some two hundred recommendations a month. In the first year of its existence it put into effect more than two thousand improvements suggested by its inspectors.

In some of the subsidiary companies of the Steel Corporation two committees on accidents are permanently maintained in each mill or plant. One of these is called "the foremen's committee;" the other, "the workmen's committee."

The foremen's committee is generally composed of the plant superintendent, his chief mechanic, and a department foreman or two. Some of the members are kept on the committee permanently, but the foremen are changed from time to time in order to give experience to the greatest number. Each month the committee makes a complete inspection of the plant. It examines not only machinery but every detail of the plant, even to floors and stairways, and it makes a report, recommending such changes and improvements as may tend to prevent accidents. Should an accident occur during the month the committee makes it the subject of a special investigation and a special report.

The workmen's committee is kept separate and distinct from the foremen's committee, and is made up of workmen exclusively. One month it may be composed of a machinist, an electrician, and a carpenter; another, of an engineer, a pipe-fitter, and a wireman; and so on until every man in the plant has had a term of service. The members of the committee are selected by the plant superintendent in consultation with his foreman. Each member serves a month. The committee makes one inspection a week, and reports in writing the result of its labors. As each member retires from the committee he is asked to continue his interest in the work and to report to the succeeding committee anything conducive to his safety or to the safety of his fellow-employes. In this way attention is held indefinitely, often to the extent that members of early committees go on making suggestions months after their terms of service have expired.

In some plants it has been found advisable, apart from these committees, to employ special inspectors for certain kinds of machinery, such as cranes, engines, and elevators. Usually such inspectors have expert technical training and are required to make complete reports upon the machinery examined. They have power to shut down any machinery found defective or dangerous.

Wherever safety committees have been appointed the effect has been beneficial. It has been found that the workmen take a new interest in safety appliances. They find them useful and make efforts to keep them in place. Where they once opposed safeguards and did little to keep them up, they willingly suggest repairs and protection devices which would often escape an outside inspector.

Furthermore, experience has shown that these inspections have a moral value, in that they serve to stimulate those who have the care of machinery to greater caution and more careful operation. The knowledge that defects will be reported once a week until repaired keep men on their mettle and cause them to see that repairs are promptly made.

As a result of recommendations made by inspectors and safety committees in the Steel Corporation stairways have been built to all overhead steam valves and connections, so that such valves and connections may be quickly reached and safely worked upon. All walks along which it is necessary to travel for the inspection or repair of steam pipes have been provided with handrails, and every stairway and walk has been specially lighted. Ladders for reaching pipes or connections of any kind have been entirely abandoned.

Danger from exploding gauge-glasses has been eliminated by using a guard made of sheet metal which can be turned in front of the glass when any one is working about it, and at other times swung back so as not to shut off the view of the register.

"Non-return valves" have been placed in all boilers and steam pipes, and so fitted as to close automatically in case of a break of any kind, thus bringing the system under control without the risk of closing the valves by hand.

In one plant of the Steel Corporation an inspector checking up accidents found that injuries frequently happened to men engaged in repairing boilers, through wrong valves being turned and steam admitted to the boilers. Examination showed him that these occurrences resulted from errors in identifying a particular valve because it was often one of a great number in a long row, all exactly alike. To guard against such confusion thereafter he caused these valves to be numbered, and red warning signs marked "Danger—Do not Remove" to be hung on them when any one was in a particular boiler. Whenever it was practicable he made it the duty of the men doing the work to place these warning signs for their own protection.

Many mills now have engines equipped with an attachment to stop them in case the governor breaks or becomes ineffective. Others have all their large engines equipped with automatic stop-valves with speed-limit attachments. These are intended to shut the engines down automatically when they exceed a certain safe speed. In one mill of the Steel Corporation there are push buttons in various prominent places, by which any engine can be instantly shut down. Each of these buttons is marked with a blue light, which is never allowed to go out. If a man be caught in the machinery or a breakdown occur one of these buttons can be pushed and the machinery instantly stopped. Nearly one hundred of these stops have been installed in this particular mill.

These buttons operate by electricity, and, to insure that they are always in order, they are used each day to start the engines. Furthermore, it is required that each button be pushed once a week with a man at the engine throttle to see that it works properly. In this same mill "Butterfly" valves (valves which close instantly by pulling a lever) have been installed as an additional protection. Chains or wire ropes are carried from the valve lever to convenient points, so that the engines can be stopped from almost any part of the mill.

Similar appliances have been adopted in this and other mills to stop electric motors, which are also operated by electric buttons placed at prominent points in the mill, and always accessible. Ropes, too, are often extended from the machinery operated by such motors to switches that can be pulled in an emergency and the machinery immediately stopped. In one mill it is reported that a workman's hand had been caught in a roller, and that, on his crying out, several fellow operators pulled the rope together, and so quickly that the switch was torn from the wall, and the motor instantly reversed, with the result that only the tips of the man's fingers were caught. Without the rope his whole hand would probably have been mangled.

In the mills of the American Steel and Wire Company inspectors discovered some years ago that many of the most serious accidents occurred in the operation of cranes. They made a number of recommendations which were immediately put into effect. Later an order was issued from the management that all specifications for new cranes should provide for all known safeguards. Some of the safeguards specified were:

A foot-walk on the side of the crane with a toe-board along the edge.

Covering for all exposed gears.

Limit switches to prevent loads being lifted too high and breaking away from the drum of the crane.

A safety switch on the upper part of the bridge, by which a workman could prevent any one's starting the crane from the cab while he was at work.

Safety couplins, brakes, and bumpers.

A gong by which the operator could warn any one underneath of the approach of the crane.

Finally, a brush or prong to move along in front of the crane wheels and push aside a hand or a foot resting on the rail of the runway before it could be caught or crushed by the wheels.

It is said that the first day a crane was fitted with the prong attachment a workman, who was busy with one leg across the crane track, was thrown aside and his leg saved from being crushed by the wheels. Another time a lineman, who was supporting himself by placing one arm around the track, was shoved away by the prong, and, though he fell ten feet to the floor, he was saved from serious injury. Without the prong his arm would have been cut off near the elbow.

Other precautions which have been taken as the result of reports of safety inspectors and committees, are these:

Projecting set screws have been entirely eliminated.

Screws on lathes and other machinery have been covered or boxed in.

Cans have been provided with light spouts ten to twelve feet long for oiling machinery, in order that the oilers may not be compelled to go into dangerous places.

Rails have been furnished for all walks along lines of shafting.

Hand rails have been provided for all scaffolds for painters and riggers.

A painter's chair with a safety belt has been adopted, so that if the man using the chair were to fall out of his seat, the belt would hold him.

Counter weights have been boxed in so that they can not fall on any one if the attached rope or chain should break.

Covers have been made for emery wheels so that if the wheels break the pieces can not fly off and do damage.

When specifications are sent from the mills of the Steel Corporation for new machinery or for building new appliances they are checked up to see that the latest safety provisions are included. In most instances the contracts which accompany the specifications contain this provision:

"Safeguarding of gears, planers, couplings, collars, set screws, etc., will be covered as fully as possible in the drawings which are furnished. But it is understood that these things shall be subject to the approval of our inspectors who shall have free access at all times to the machinery while it is in process of construction and erection."

Some corporations cause to be printed on the stationery of their purchasing departments this motto:

"Provisions for safeguarding workmen should be brought to our attention, as we will consider them in selecting new machinery and equipment."

Often in big enterprises an effort is made to impress upon the workmen the necessity for using care. Instructions are printed on their pay envelopes that they must be careful of themselves and of their fellow-workmen. Similar instructions are also frequently stamped on time sheets and requests for material.

Some of these instructions are:

"Always be careful and take no risks.

"You are responsible for the safety of others as well as yourself.

"Carelessness as to the safety of yourself or others will be sufficient cause for dismissal."

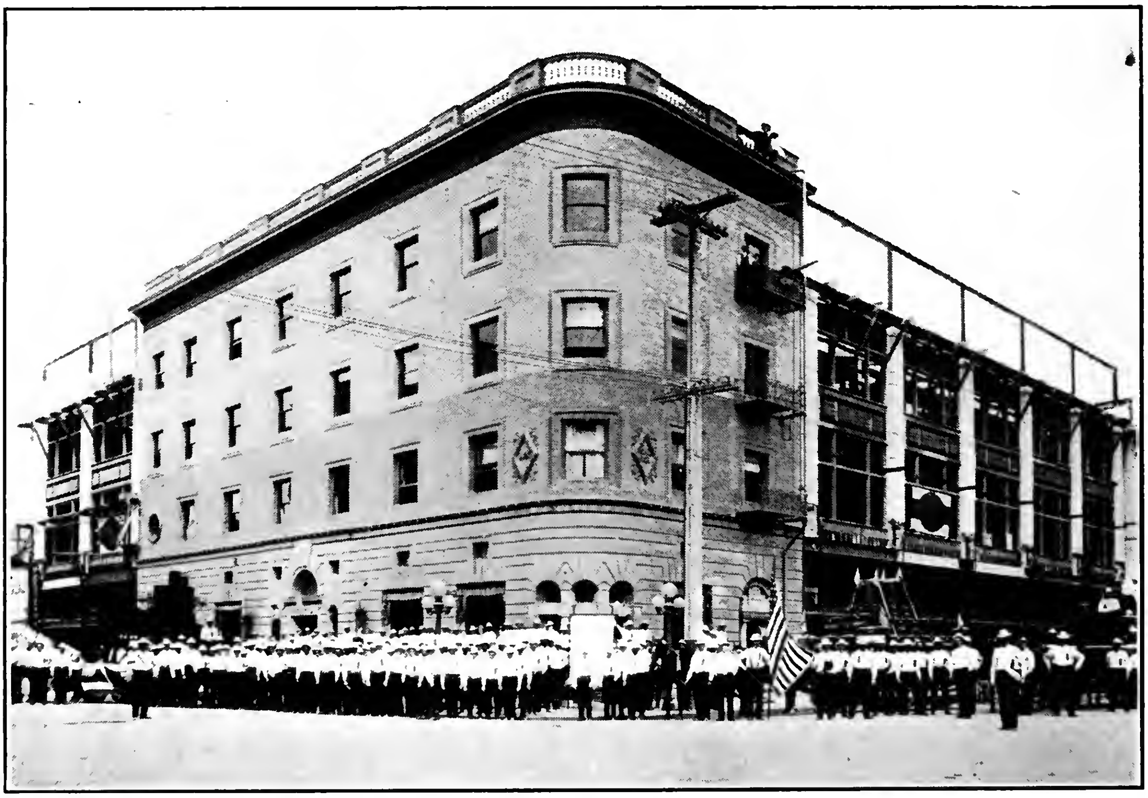
Another result of inspection has been the more frequent placing of warning signs about dangerous machinery. For instance, in many mills of the Steel Corporation notices are posted at ladders or runways leading to cranes, instructing workmen to notify the crane operator before doing any work on the crane. Notices are posted over valves, switches, and control levers, to guard against their being started while men are working where exposed to injury. Notices are also placed over elevators, to show when the elevators are in operation and when they are not. And notices are placed over electric switchboards (often in five or six languages), to show the voltage, and whether the current is on or off.

The steps taken by the corporations referred to suggest what can be done along similar lines in other industries. Some system of inspection can be established even in the smallest

plant. Where workmen are employed in any numbers safety committees can be organized with good results. Even the most limited inspection will prove profitable. Inspection will bring inquiry and investigation. And whereever there is either inquiry or investigation there also will be found reform and a striving for better things.

The Company's Oakland Gas Men

IN Oakland the regular employees of the company's gas department number two hundred and twenty-five men belonging to the gas workers' union. So when there was a big parade California's labor day, Monday, September 5th, that force made quite a showing with numbers and with three floats and with an ensign carried on a frame decorated with different forms of gas burners. One of the floats bore a miniature oil-gas machine, showing the machinery in which Oakland's gas is manufactured. Another was laden with large-size gas meters. The third displayed various gas appliances.



The accompanying illustration shows the gas workers drawn up in front of the company's Oakland office. This is the building which has recently been enlarged by the addition of extra stories, an improvement required because of the unusual growth of the trans-bay communities since the San Francisco fire.

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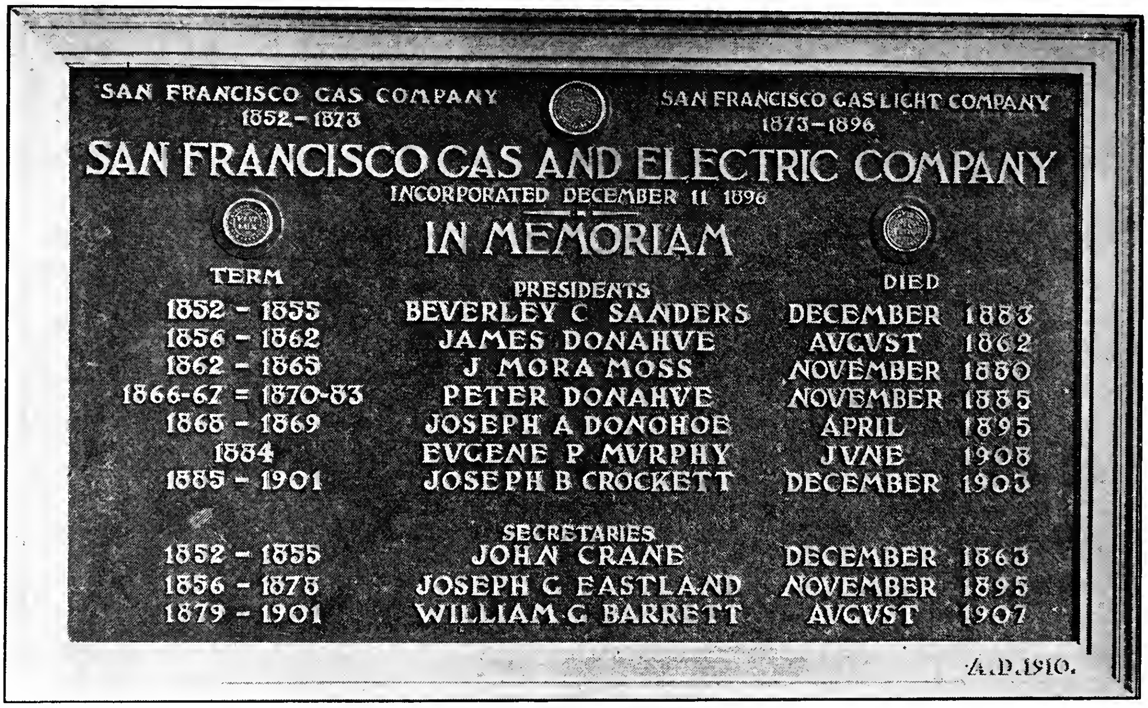
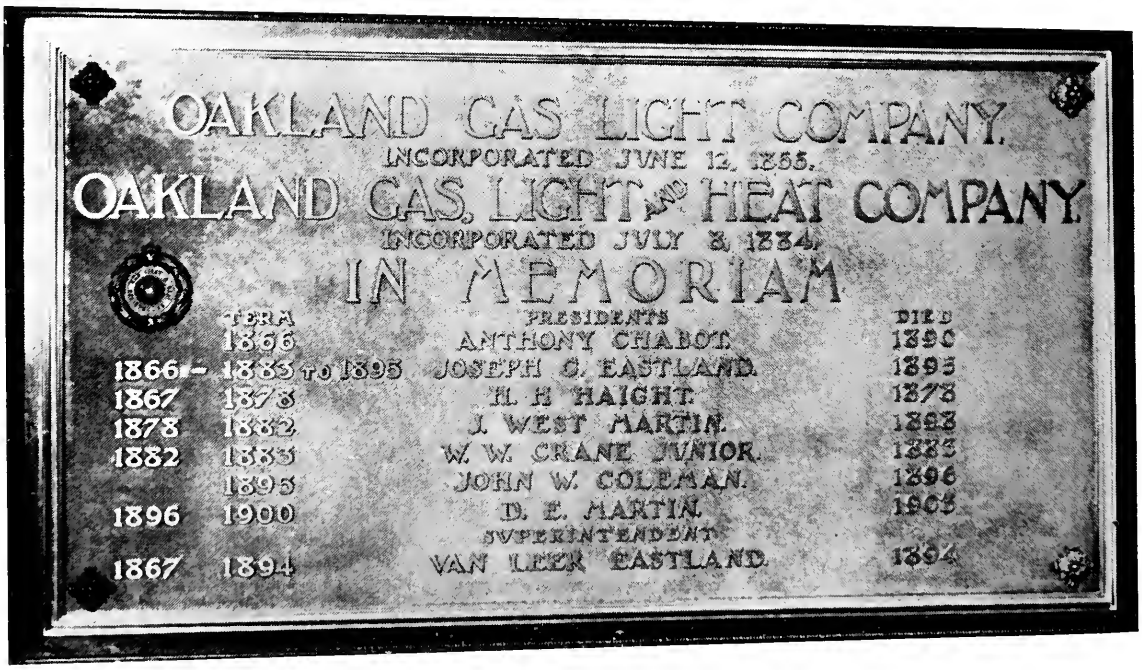




THE BRONZE MEMORIAL TABLETS RECENTLY PLACED IN THE WALLS OF THE SAN FRANCISCO AND OAKLAND OFFICES (About one-tenth actual size)

PACIFIC GAS AND ELECTRIC MAGAZINE

VOL. II NOVEMBER, 1910 No. 6

Oakland Station

By C. F. ADAMS, Engineer of Electric Construction.

C. F. Adams

The brick station at the corner of First and Grove Streets in Oakland has just completed a chapter of its history. For twenty years it was a steam station, and a model of its kind. Now it is the terminus of a transmission line and the distributing centre of Oakland's power and light service.

When the first alternating-current dynamo was purchased for this station a few years ago, a 75-kilowatt machine was considered large enough to supply the demand for years to come.

The street lamps were then operated by direct-current arc dynamos, and the entire equipment was belt-driven. Slow-moving Corliss type engines were the motive power, and long countershafts with friction clutches were used to drive the group of machines.

When alternating-current motors became a reality, larger generators were required and finally the station equipment consisted of three 500-kilowatt generators, one 875-kilowatt motor generator, one 150-kilowatt, and one 250-kilowatt motor generator sets. Three horizontal compound engines were in use and one vertical compound engine with direct-connected generator.

The original arc lamps had all been superseded by alternating-current arcs, operated from constant-current transformers.

In 1908, after a careful inspection of the station, a general reconstruction was advised in order to place the Oakland service on a permanent high-grade basis.

The old station had wooden upper and main floors, as well as a wooden roof. The brick walls bore traces of April, 1906. The total steam equipment had been superseded in service by the single 9,000-kilowatt turbine in the new Station C. The south end of Station B had been used for some time as a pipe shop. The high-tension transformers were in a galvanized and wooden frame structure, known locally as "the tin can." The switchboard was partly in the transformer room and partly in the gallery of Station A. The plant as a whole was outgrown and a bad fire risk.

The new arrangement proposed was to remove all combustible material from Stations A and B. All the high-tension transformers were to be moved to Station B, and the iron building abandoned. All the switchboard apparatus, regulators, and arc transformers were to be combined in Station A. Provision was to be made for a future underground service to be run from this station, which would dispense with all the overhead wires to the business district and thus avoid the fire risks to the line and the consequent interruptions.

During this work all service would have to be maintained without interruption and the

building work would have to be completed before the winter rains came.

The old switchboard was maintained in service during construction, as its location on a side gallery was not disturbed by the building changes. Wooden shelter houses were built over the motor generators to protect from dust and falling debris. The driving belts and rope transmission were removed. Machinists with sledges and chisels tore out countershafts and engines piecemeal, and the work was on. Then the wooden roof was lifted and the blue sky let it. Old foundations were blasted out to make room for new, and for months the place was the scene of turmoil and labor, day and night. Junk men, vultures of commerce, flocked about and viewed the spoil, and the wreckage went to the highest bidder.

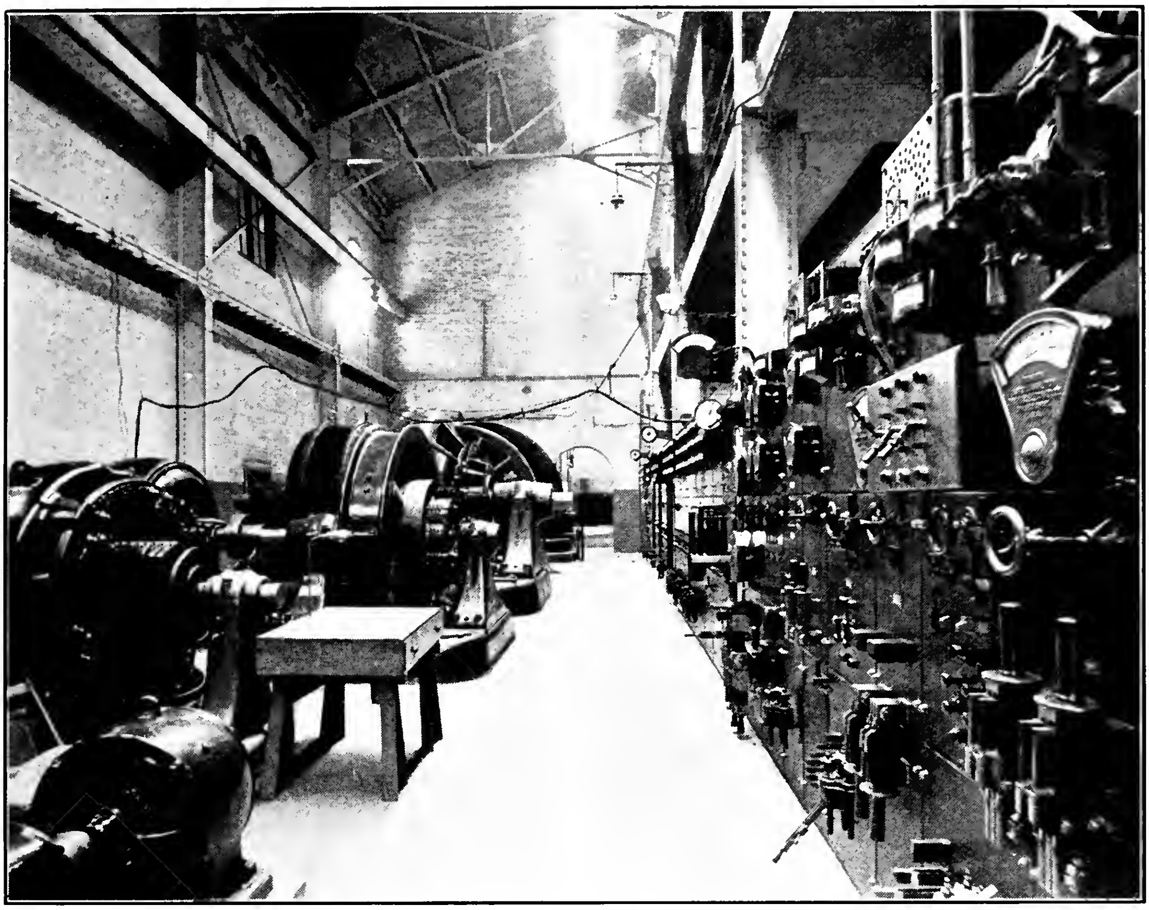
Station B was the first to take form. A steel frame secured to the brick walls supported the new steel roof. A concrete gallery for the 6,000-volt switches and a concrete floor for the transformers completed the building work.

The 875-kilowatt motor generator was moved into Station A. The high-tension lines were brought in, and the transformers were soon shifted and in service.

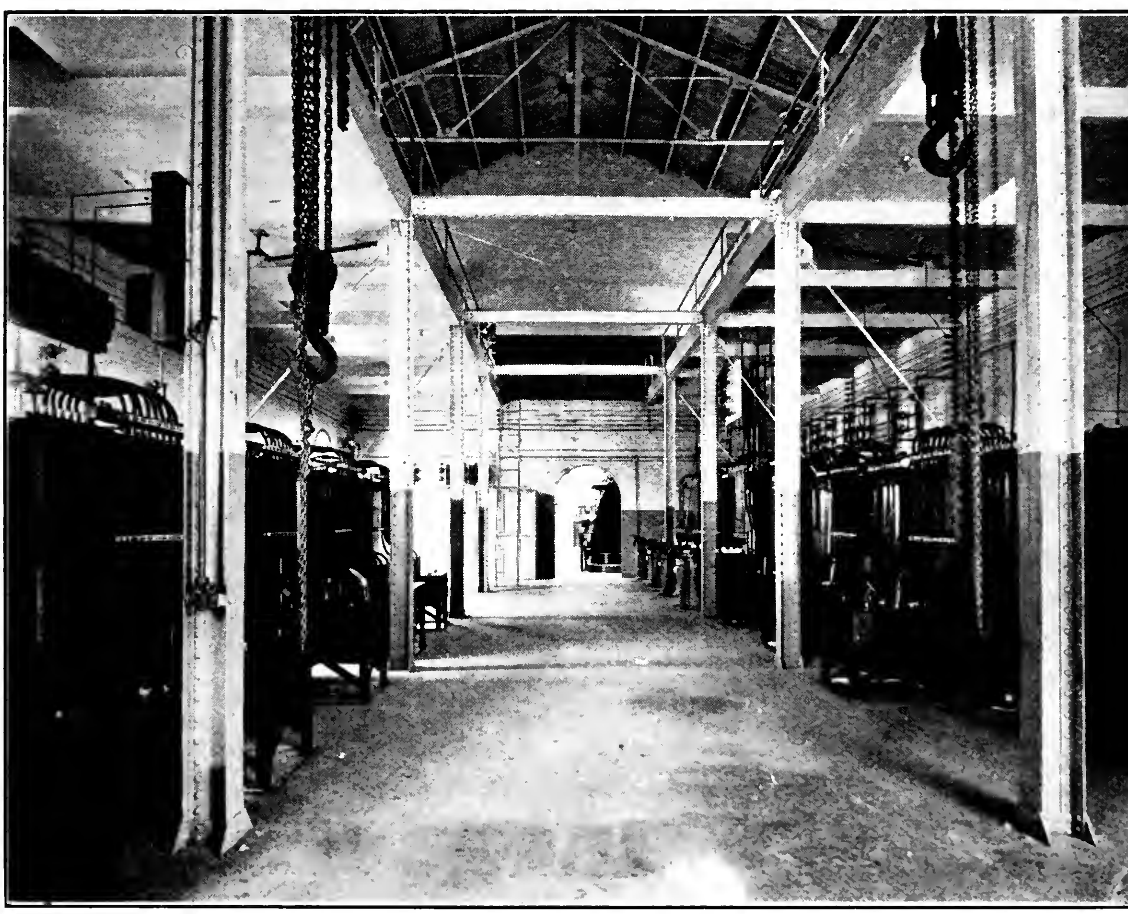
The new station is roomy and light. All conductors from transformers to switchboard are placed underground. The 60,000-volt switches for transformers are automatic and solenoid operated. They are controlled from the main switchboard.

The work in Station A was of greater magnitude. A 1,000-kilowatt generator was erected to operate the street railroad load. Two steam engines with shafting and generators were completely dismantled. The 250-kilowatt motor generator set was shifted to Elmhurst, a smaller set was sent to Sacramento, and one of the 500-kilowatt alternators was forwarded far up the cañon of the Ameri-

Station A, First and Grove Streets, Oakland



Main floor, Station A, Oakland



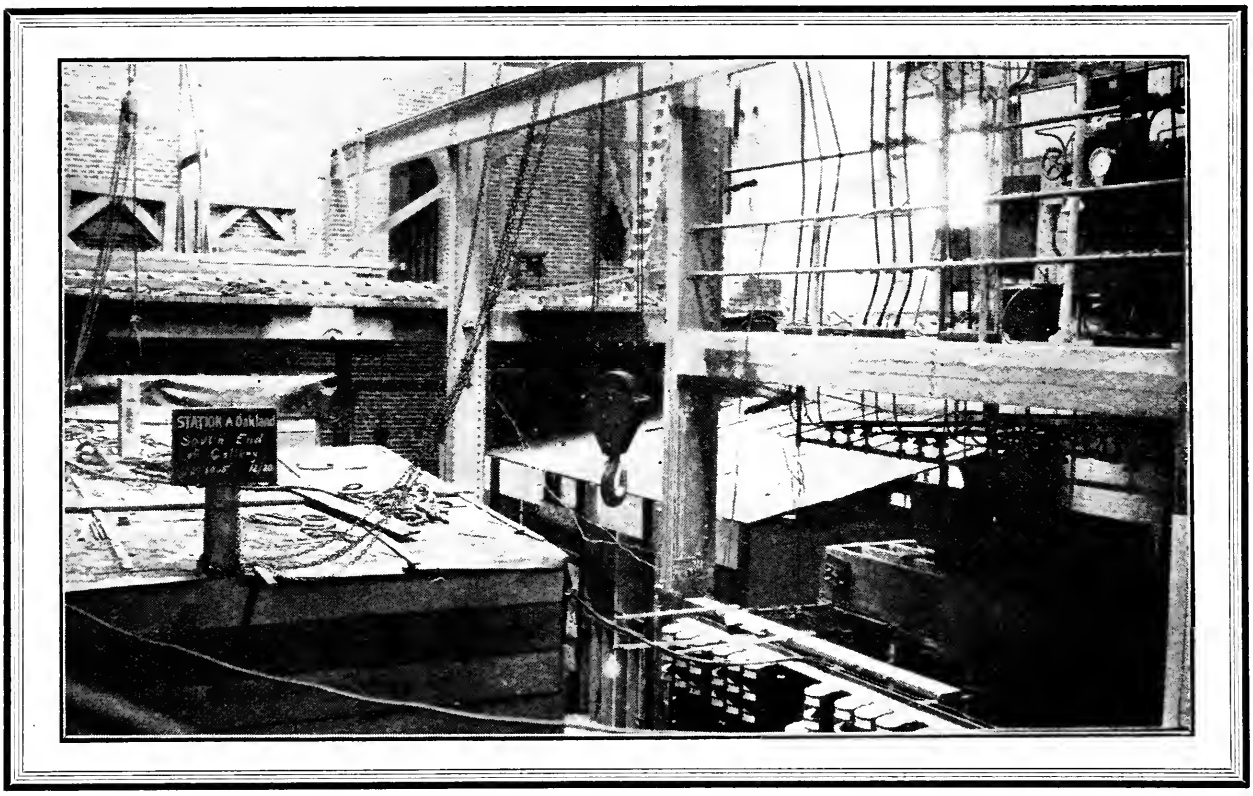
Main floor, Station B, Oakland, looking toward Station A

can River to run some gold dredgers. A new exciter set was procured and a 200-kilowatt motor generator for the all-night, direct-current service. Provision was made for a storage battery, and the necessary "booster" and switchboard were installed.

A double bus concrete cell structure, was built to contain all oil switches. Duct lines were run to all power transformers, motor sets, and to enclose the main commercial feeders. A complete new switchboard was built to control all station apparatus and lines, including the turbines and exciters in Station C.

A gallery of concrete and steel was constructed to extend the length of the building and support arc tubs, feeder regulators, and main.

All wiring was to be supported on metal frames or within metal conduit.



Interior of Station A during the reconstruction work of December, 1909, when the roof was off the building but the station in regular operation. The nearer box-like structure was the temporary protective covering for a 1,000-kilowatt motor generator set; and the one on the right covered a 1,000-volt bus.

The illustrations convey the story of what the station is now, but no views are available to show the old station. Not a single serious accident occurred through the entire reconstruction, neither loss of life nor personal harm and there was no greater average of service interruption than was normal to the old station. The entire work, planned and executed by the engineers and construction forces of the Pacific Gas and Electric Company, represents an outlay of approximately $150,000.

Installation is being made of a 1,000-kilowatt General Electric motor generating set in the Sacramento substation to meet additional power service demands.

A substation is being erected near Decoto in Alameda County to supply the Oakland Paving Brick Company from the 60,000-volt line.

Why the "Rome" Power Plant is Closed

THE little old "Rome" power house up in Nevada County has passed through a crisis in its career. For fifteen years it has steadily generated electric energy there on the brink of the south Fork of the Yuba River, way down at the bottom of a cañon formed by steep-sloping ridges of the Sierras. It was the first electric power plant in America to use a high fall of mountain water to generate light and power for distant towns. Starting small, with the part of the building that still stands on the upstream end, it grew with the years and solved many of the problems of hydro-electric science. Its first force came from water dropped from the end of a flume led gradually along the mountain side from a river dam three miles upstream. Then an artificial lake was created on the hilltop almost directly above the plant, and from that a greater fall was produced to operate the wheels in both the old and the new parts of the plant, the old flume supply still being used to do its part of the work.

Just what has happened to the "Rome" plant is told in an article that appeared in the Grass Valley Tidings of October 29th. Here it is:

Probably few people knew yesterday that the change of the electric light and power system in Nevada City and Grass Valley from the old 133 cycle to the modern 60 cycle meant the temporary, if not the permanent, abandonment of the Rome power house, the oldest of its kind in California. And in the passing of that useful utility, if it is to pass forever as an active factor in the development of the commercial and industrial resources of this part of the state, many memories are revived.

The Rome power house was the precursor of the great electric light and power systems as we now have them, not only in California but throughout the United States. It was built and equipped in 1895 by the Nevada County Electric Light and Power Company. At the head of the company, and its moving spirit when it was organized, was Alfonso A. Tregidgo, now manager of the St. John's quicksilver mine in Solano County. Tregidgo, who was then a mining and civil engineer in Nevada City, organized the company, sold most of its stock through his own efforts, and started on its journey an industry that was not only destined to electrify the state, but to revolutionize its industries, its commerce, its finance.

The contract to build the Rome power house, equip it with electrical appliances, and construct the power lines was let to John Martin, the agent in San Francisco of the Stanley Electric Manufacturing Company. Martin put in a bid for constructing the plant and was successful. He superintended its construction, paying many visits to the county during the time. What changes have come over the fortunes of John Martin since that time! Then he was practically an unknown man with a keen business intuition and an eye for "the big chance." Today he is one of the foremost men of the Pacific Coast, extremely wealthy and associated with most of the large enterprises in California. He is a great power in financial and industrial circles.

Eugene de Sabla is also another man who has become extremely wealthy and powerful through his association with Tregidgo at the time of the organization of the old Nevada County Electric Light and Power Company. De Sabla was a resident of Nevada City when the company was formed and a personal friend of Tregidgo's. He secured a large block of stock in the concern and held onto it. He has continued with the electric light and power business to this day, having participated in the development of the industry from the little Rome power house to the magnificent plant at Electra, Amador County, which is said to represent the acme of electrical genius and equipment.

When Alf Tregidgo started the Nevada County Electric Light and Power Company and solicited among the mining companies for the privilege of supplying electric power for propelling machinery, some of the managers actually laughed at him. They had become so much accustomed to the old water-power system, and where water was not available to steam, that it was inconceivable to them

that any other power could be utilized. How little they knew of the great use to which electric power was destined to be put right here in Nevada County, the home of the nucleus of the great electric system in California today.

George Mainhart, then manager of the old Omaha mine at Grass Valley, was the first to have the temerity to use electric power. Many predicted failure for the fluid and the man who used it. But Mainhart and the promoters of the electric system were ahead of their fellows, and it was not long before other mining companies that found it difficult to obtain water for motor purposes and steam too costly, were using electric power. In fact, the demand became so great within a year that the company had to look about for capital with which to build additional plants to supply its customers.

At this juncture Martin and De Sabla were made acquainted with Colgate, head of the great soap firm of that name in New York. Colgate sent his representatives out here to investigate the project. They saw the possibilities of electric light and power in the development of the virgin resources of California, and Colgate consented to take an interest and help the company in disposing of its bonds. The result was the building of Colgate, across the river from French Corral, the first great electric light and power plant to be constructed in California. It was named in honor of the millionaire soap manufacturer.

Since that time the electric light and power business has gone ahead by leaps and bounds in this state, and John Martin and Eugene de Sabla have always kept abreast of the wave. They have been leaders in the industry that has revolutionized the business and industries of the state. They stayed with the ship, and have always been at the helm directing it. They are recognized today as the two most powerful men in the electric business on the Pacific Coast. Tregidgo dropped out of the company many years ago and went back to mining, but Martin and De Sabla kept steadily on with the business until today they have practical control of the light and power plants of northern California.

The little plant at the Rome power house, which was considered obsolete enough to be abandoned for the more modern equipment, was the nucleus of the great electric systems of California. Its influence radiated until it has developed from a small beginning—the first prospectus of the company called for an expenditure of $55,000—to the second biggest corporation in California or on the Pacific Coast. The influence of the present company, which was evolved from the old Nevada County Electric Light and Power Company, is shown in the recent absorption of the mammoth plants of the Great Western Power Company, next to the Pacific Gas and Electric Company, the biggest in California.

In the future Nevada City and Grass Valley will be a part of the greatest electric system in the world. If anything happens at Colgate light and power can be had from Deer Creek, Alta, Electra, or even from San Francisco, where the company has a plant for the generation of electric light and power.

The company of today stands as a splendid monument to the men whose prescience, genius, and dogged determination have made it what it is.

William Cox, who designed and placed on the market a gas-flow computer for both high and low pressures, and which is a familiar sight on most engineer's desks, died recently in New York. He is survived by his widow, who has issued a new edition of his computers.

A. R. Thompson has been appointed general superintendent of electric distribution for the San Francisco Gas and Electric Company. His work began November 1st. The electric superintendents and foremen in San Francisco will hereafter report directly to him.

The county-seat of Placer County is scattered along in three business sections over a stretch of about three miles. At one end is Auburn, at the other East Auburn, and each has its separate postoffice. If the elements could agree to combine on a central postoffice location the united community has population enough to secure free delivery.

Notes on Service Work

By D. E. KEPPELMANN, Superintendent Meter Department, San Francisco.

D. E. Keppelmann

The laying of services has become an important subject to gas companies. This is so because most of the unaccounted for gas or the leakages in the distribution system have been traced to the services due to faulty workmanship and the destructive properties of the earth. Wrought-iron pipe is almost entirely used for services on account of its greater strength compared to cast iron, especially in sizes one-inch to three-inch diameter. It also more easily connects to the mains. It has the disadvantage of corroding in most soils. Corrosion is much more rapid in soil composed of furnace ashes, sand, and gravel, and much less in clay. As a large percentage of the soil in large cities is made ground, composed of ashes, cinders, and general refuse, the life of a service-pipe is dependent upon the precautions taken to prevent corrosion. There have been several coatings made, the basis of which is coal tar, that have given varying degrees of success, according to the formula used. The following is the method for making the Hickenlooper tar coating, which has given the best satisfaction to date:

Bring a kettle of tar (20 gal.) to a low boiling point and add 20 lbs. of fresh slaked lime sifted over the top and worked down. Boil down to a paste of a consistency midway between tar and pitch. Let it settle for a few minutes and add 4 lbs. of tallow and 1 lb. of powdered resin, stir until thoroughly dissolved, let cool and ladle into barrels. When ready for use, to each barrel of 45 gal. of above mixture, add 4 lbs. of crude rubber dissolved in turpentine to the consistency of thick cream. Heat the mixture to about 100° F. and immerse the pipe after it has been heated to the same temperature. As it requires slow and careful work to dissolve the rubber, there is a tendency to omit it from the formula in order to cheapen the cost of production, but an inferior coating is the result. The cost of coating a service-pipe with the above is about one-tenth cents the lineal foot; while the life of the pipe is greatly increased. After the pipe has been laid, it should be given an additional coating preparatory to filling in, taking care to cover all abrasions and wrench marks. It is the practice in some districts to wrap strips of muslin around the pipe the entire length, after which it is thoroughly coated. In addition to coating, when clay can be obtained it should be puddled around the pipe to prevent the moisture, which becomes charged with acid compounds in percolating through the soil, from attacking the pipe.

The first consideration in laying a service-pipe is to determine the location. This depends entirely on local conditions, the object being to bring the service into the building within two or three feet of the house-riser, avoiding water and sewer connection ditches, and breaking the foundation wall at a point that will not seriously weaken it. In locating the service, the proposed location of the meter should be considered. It should not be placed under steps, in vaults, near furnaces, or in any place where it cannot be reached quickly in case of fire or accident. But conditions arise when some of the foregoing precautions can not be carried out, in view of such obstructions as vaults, bake-ovens under foot-ways, no cellars. In laying new services to old buildings, it is the practice to locate the service under a cellar window or front door near the riser.

When existing services are renewed or enlarged, the location remains the same, other things being equal. In arranging for new services to proposed new building operations, the architect or builder should be consulted as to the proposed location of water and sewer connections with reference to the party walls. This information should be obtained as soon as the operation is commenced so that the foundation sleeves can be placed in the front

walls as the stone work is laid. The sleeves should be placed on the opposite party wall from that occupied by the water and sewer connections without regard to position of riser. A representative of the gas company should supervise the placing of sleeves to insure their being placed at the proper depth and inclination. This arrangement admits of two services being laid in one ditch and eliminates the danger of damaging walls. The use of the terms "long wall" or "short wall" enables the man placing sleeves to locate them accurately. In isolated buildings the terms N. E. S. W. walls can be used.

It was the practice in former years, when making service connections, to gauge or diamond-point a hole in the main of less diameter than the tap; the hole being brought to size by a reamer and then tapped. There was a danger of asphyxiation by this method and loss of gas, together with the fact that very often irregular-shaped holes were the result. The full sectional thickness of the pipe was not preserved in all cases, providing insufficient support for the fitting. With the invention of the Light and Mueller drilling machines, with their devices for preventing escape of gas while drilling, and the combination tap and drill, it is now possible to drill holes more rapidly without discomfort to the man, and insuring a hole tapped the full sectional thickness of the main.

In the earlier days of the gas business in this country, the practice of drilling and tapping cast-iron mains for services was more difficult and dangerous than that of today, as carried out by the larger and up-to-date gas companies. At that time any safety device to protect the workman was a rarity, and many times when the work required the cutting out of a main a workman was overcome by gas—sometimes several were. Often some were made unfit to proceed with their work again that day.

The progress toward the safety tapping machine we have today has been very slow. Up to about ten years ago the boiler ratchet with a tapping crow was used. Another method was that of marking around the desired size plug, cutting out with a diamond point, reaming and then tapping the hole, making three operations, the gas escaping during the last two. This is now all done in one operation with the combination drill, reamer, and tap in a safety tapping machine which prevents any escape of gas.

In view of the fact that tapping holes and connecting services weaken the main to a certain extent, precautions are taken to overcome this as the size of the service increases. No services, except those to supply street lamps, or in high-pressure districts, are laid of less diameter than one-and-one-quarter-inch, the excess of cost over smaller sizes being balanced by such considerations as additional strength, allowance for partial obstruction, and future gas range installations.

To avoid as much as possible the weakening of mains by holes being drilled too large and too close to one another, they should be kept at least twelve inches apart. When drilling for services, no hole larger than is shown in the following table should be made, provided the main is in good condition; if not, or if a larger size hole is required, a split sleeve or a saddle must be used or a tee cut into the main:

SIZE OF MAIN	HOLE
3 inch	¾ inch
4 "	1 "
6 "	1½ "
8 "	2 "
12 "	2½ "
16 "	3 "
20 "	4 "
30 "	4 "

In operation work where for any reason the service can not be run before the main ditch is back-filled, time will be saved by having the service holes drilled and plugged while the main ditch is still open; so that when the service gang is prepared to go ahead with its work they will not have to excavate below the top of the main or dig an enlarged ditch in order

to allow the drilling to be done. This pays particularly in cases of large-sized mains where considerable digging is necessary in order to get the chain under the main to set the drill-press.

Each service should be supplied from a separate hole, for it has been found where two services are supplied from the same hole that the clearing and stoppages in one affect the other. Also there is more strain on the main than when one hole supplies each service.

The use of the swing-joint at the main is an insurance against broken pipes in case a settlement of the main takes place, allows the interior of the main at that point to be inspected, and affords a means of shutting off the flow of gas by placing a rubber stopper in the service tee while the service is being laid. This is probably the most important use of the swing-joint.

Services should be driven under a cement footway in order to save cost of replacing pavement and preventing annoyance to the consumer. In driving services, the proper inclination should be insured by the use of the spirit level. When it is necessary to renew or enlarge a service pipe under cement footways, the new pipe is attached to the old service in the cellar and pulled through the opening made in the cellar wall, under the pavement to the street. This operation is assisted very much by pouring water into the stop-box when it is located near the house line. The water is then made to flow along the old pipe toward the street, washing a channel for the new pipe. This method precludes the possibility of opening the seam of the pipe, an accident which might result were a sledge used to force the pipe. All driven surfaces should be tested under a pressure of at least four inches of water to insure their tightness. It frequently happens that the portion of an old service is renewed from the main to the curb-cock. That portion of the service under the footway being allowed to remain in should be tested for tightness when work is completed by attaching a gauge to the head of service and closing cocks at curb and meter. Any leakage may be detected by a drop in pressure. This is very important.

It is quite important to use some method of protecting exposed screw threads from corrosion. This may be done effectively by covering them with Portland cement in much the same way a cement joint is faced or finished. Recessed fittings are an improvement over this method, in as much as they serve the purpose of covering the threads effectually, prevent female threads of the fittings from becoming burred during transportation and permit male threads to be entered with more ease than the usual fitting. Services should be dripped, or caused to incline toward the main whenever possible. In cases where insufficient covering for the services would result from this, that is, on account of obstructions encountered, the service may be inclined toward the cellar where a suitable drip is attached, or, in cases of no cellar, a service drip may be placed between the main and the curb. The latter method adds to the cost of installation and maintenance.

They Praised the Corporation!

In the Vallejo Chronicle of November 11th, 1910, appeared the following article, which is reprinted here because of the rarity of such recognition by the daily press:—

DO FINE WORK

All of the streets opened by the Pacific Gas and Electric Company for the purpose of installing new mains have been closed again and are in first-class shape for the winter. Street Superintendent Savage and the various drivers of delivery wagons are loud in their praise of the work done by the big corporation.

The Los Angeles Gas and Electric Corporation will shortly install at its plant a Rotary Meter to measure the air used in the revivification of iron oxide.

Electric Talks

III. Electro-Magnetism

By JOSEPH P. BALOUN, Head of Draughting Department.

Joseph P. Baloun

Now we come to the relation between magnetism and the electric current. No current can flow in a conductor without producing the action of magnetism around its path. This theory of the flow of electricity assumes that a series of magnetic lines or concentric rings is around every conducting medium. These rings are close together near the wire and increase their spacing as their distance from the wire increases radially. This is indicated in Fig. 1.

These encircling lines of force always flow in a certain direction around a wire for a given direction through the wire. One of the simplest rules for remembering this connection between the direction of flow in a wire and that of the surrounding path is to conceive a wire passing through the centre of a watch, passing through from the face to the back. Now if we assume the current to pass from the face to the back of the watch, then the direction of the flow of the magnetic lines of force will be in the direction of the travel of the hands of the watch. If the direction of the current be reversed, then the direction of the magnetic flow is also reversed.

It must be thus noted that electro-magnetism is distinguished from magnetism in a permanent steel magnet. For it is the magnetism produced around a conductor when a current passes through it. Such a magnetic field is set up around every current-carrying conductor. The influence of the magnetic field when brought near to a magnetic compass needle is as effective as that due to the influence of the magnetism of a steel bar magnet.

A current-carrying wire will attract iron filings similar to a magnet, as shown in Fig. 2; but if the current be broken all the filings will drop off.

Since the filings are magnet bodies free to move, they arrange themselves in the circular direction of the magnetic lines of force surrounding the wire. It will be noticed that the circular lines of force do not merge into, cross over, or cut into one another, but complete their circuits independently around the wire.

A very pretty graphical field of circular currents is arranged in Fig. 3 by securing a circular turn of wire vertically over a horizontal piece of cardboard. Passing a current through the wire and tapping the cardboard will sift the iron filings, and they will arrange themselves circularly around the wire as indicated.

If a magnetic body be held over the centre of a circular loop, with its axis over the centre of the loop, it will tend to move downward, as shown in Fig. 4. This same tendency will exist even if the loop be of the form shown in Fig. 5.

In just the same way as we reasoned that the magnetic lines of force leave the N pole of a bar magnet and re-enter again the S pole, in a similar manner can our reasoning be applied to an electric circuit.

If a steel ribbon or band be substituted for a wire ring, as shown in Fig. 6, the direction of the flow of the current around the loop is clockwise. The direction of the magnetic lines around the band is also clockwise if you look in the direction of the current. Consequently one edge or face of the band is of north, or N, polarity where the currents emanate, and on the near face, where it enters, is the one of S polarity, as indicated. If the current were sent in the opposite direction in Fig 6 then the direction or path of

the lines of force around the band would also be reversed, and the N and S faces of the band would also be interchanged.

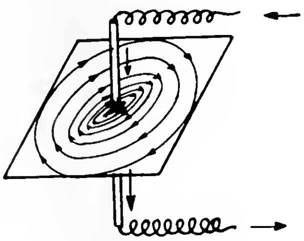


Fig. 1

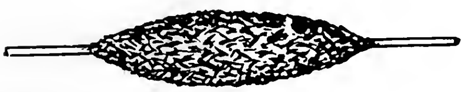


Fig. 2

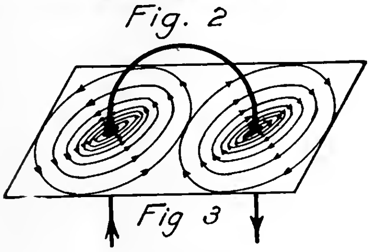


Fig 3

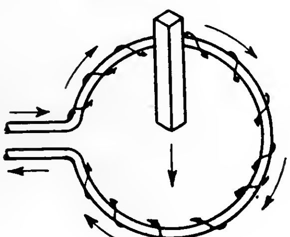


Fig. 4

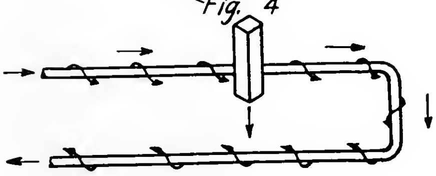


Fig. 5

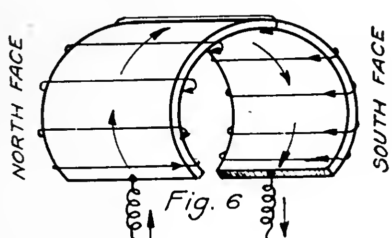


Fig. 6


Fig. 7

Solenoids, or coils of wire, depend for their attraction and repulsion qualities upon whether the wire is wound on the core in a right-handed or left-handed direction. See Fig. 7. The wire for a solenoid is usually wound on a brass, rubber, or wooden core or spool. The length of these spools is much greater than their diameter. The winding is always in the same direction, and layer upon layer like a spool of thread. The polarity of the solenoid can be reversed by re-winding in the opposite direction, or by simply sending the current through the coil in the opposite direction.

A commercial solenoid is shown in Fig. 8. The strength of the magnetic field inside the

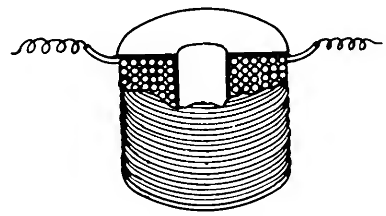


Fig. 8

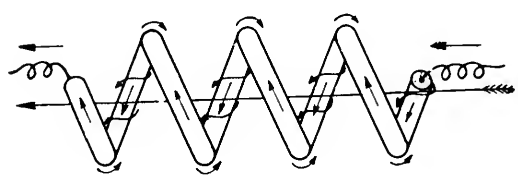


Fig. 9

spool is the sum of the magnetic lines of each individual turn, as illustrated in Fig. 9. Here it is noted the magnetic lines of one turn join to the next, and so on, so that the sum of all the turns constitutes the field, or total lines of force passing through the solenoid. The direction of this magnetic field inside of the core is also the same as the direction of the individual lines of force on each turn of wire.

An iron core introduced into a solenoid makes an electro-magnet, and when the iron is magnetized the lines of force pass with the circuit be through air there is considerable opposition to the passage of these lines of force. This magnetic resistance, which is called reluctance, is made up of the iron part and the air part of its path.

As magnetising force is measured in ampere-turns it will be necessary here to insert a passing definition of an ampere.

Since the strength of a current of electricity is directly proportional to the amount of chemical decomposition it can produce in a given time, and as a uniform current passed through a nitrate of silver solution in water deposits silver at the rate of .001118 gram a second, this value has been taken as a unit of current strength and is called an ampere. So one ampere-hour is interpreted to mean a current with the strength of one ampere for an hour's time or four amperes for one-quarter hour. One ampere-turn is equal to a current of one ampere flowing through one turn or convolution of a coil or solenoid. In the same manner ten ampere-turns may be ten amperes through a coil of one turn or two amperes through a coil of five turns.

The reluctance of iron increases as the number of lines of magnetic force increases. Therefore, doubling the ampere-turns will not double the lines in the iron. As the number of lines increases a point is finally reached where the ampere-turns produce only a very feeble increase in the flux. This condition is called the magnetic saturation. The flux through other materials than iron, such as air, copper, or water, is in exact proportion to the ampere-turns.

One ampere-turn will produce a flux density through air or a non-magnetic substance of 1.256 lines the square centimetre, if the length of the magnetic circuit be one centimetre. If the length of the circuit be one-quarter centimetre long the number of lines will be $\frac{1.256}{.25} = 5.024$. In other words the density will be 5.024 lines the square centimetre for each ampere-turn. For 1,000 ampere-turns the number of lines will be 5,024 the square centimetre.

The lines through air a square centimetre $= \frac{At \times 1.256}{L}$, in which

At = Ampere-turns
L = Length of circuit in centimetres.

The ability of a substance to carry magnetism is called permeability. For air the unit = 1. The permeability of iron is as high as 2,500 at a low density. But if the iron be in a state of magnetic saturation the value of the permeability will drop to below 300.

The pull exerted by an electro-magnet acting on a piece of iron is $P = \frac{B^2 A}{11,183,000}$, in which

P = Pull in pounds avoirdupois
B = Number of lines the sq. cm.
A = Area in sq. cm. of both poles.

(To be continued.)

A zig-zag arrow has been adopted in Germany as a warning of high voltage. The design is painted in white in some conspicuous place of all high-voltage devices. The result is that any workman, visitor, or trespasser has the fact thrust upon his attention as a warning, just as the familiar skull and cross-bones is the emblem of poison on a druggist's label.

The government's so-called Rio Grande project implies the reclamation of 180,000 acres of land in New Mexico and Texas. Construction work is in progress on the Eagle dam, which is the most important engineering feat of the project. This dam is to be completed by July, 1911, and will measure 1,400 feet across the crest from bank to bank, will be 265 feet high, and will contain a mass of rubble and concrete to the amount of 410,000 cubic yards of material. It will be the largest dam in the world, and the reservoir created by it will have a capacity of 2,538,000 acre-feet, a capacity greater than that behind the famous Assouan dam constructed in the valley of the Nile by English engineers. The whole project implies an expenditure of $9,000,000.

How Salt is Made From Ocean Water

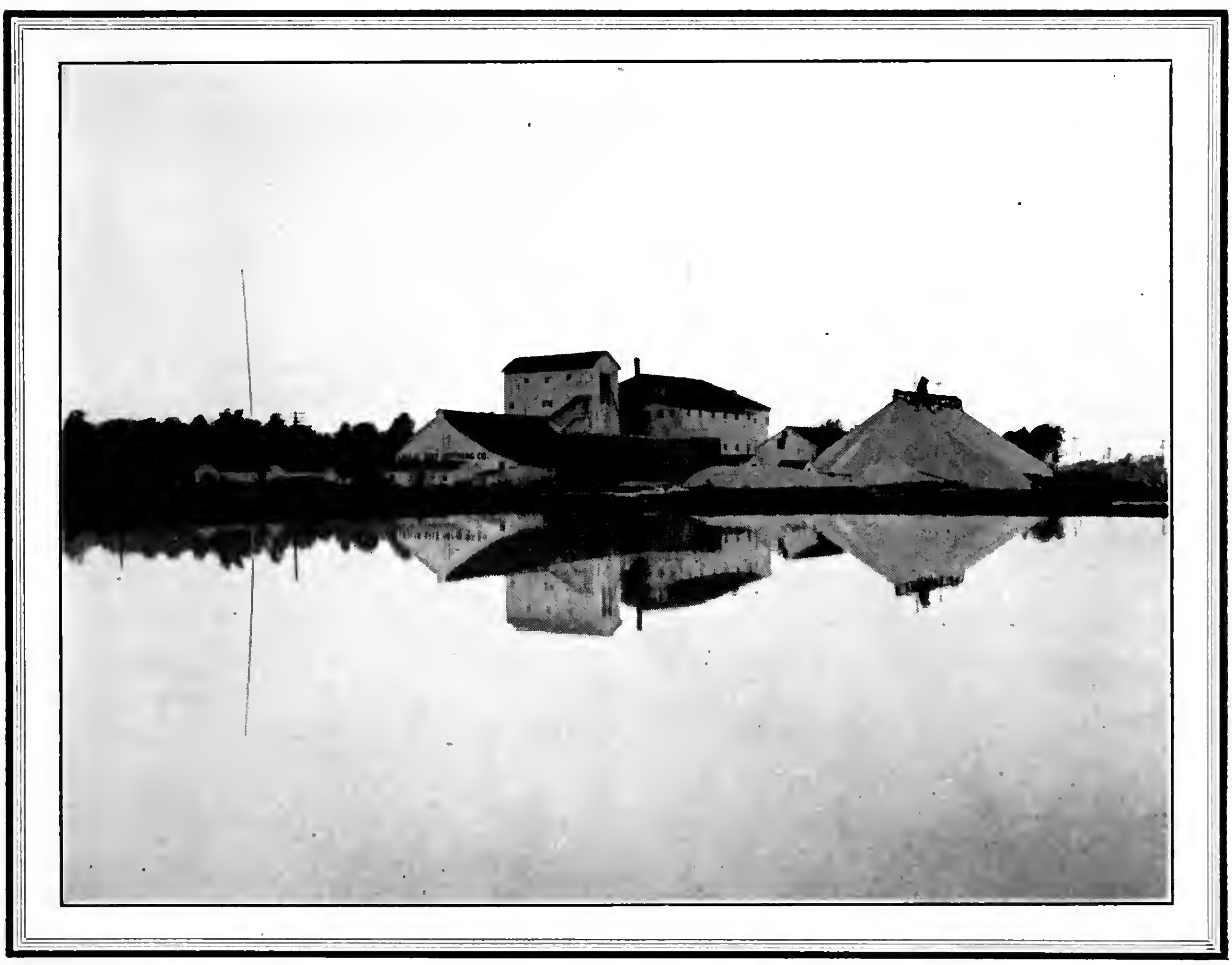
SALT is obtained from salt mines and by the evaporation of ocean water. That found in mines exists in large crystalline masses, probably the deposit from some prehistoric sea. Nearly all water contains a little salts, and the aggregate of all streams of the earth flowing into the ocean for thousands of years has made it salty, because when water evaporates its salt is left behind. Rainclouds take up moisture from the sea but leave the salt. But the rain and the rivulets wash salty matter out of the earth and carry it down to the sea as a new supply.

There are great salt mines in Siberia and salt works in England. There are salt mines in Kansas, and salt mines on Carmen Island in the Gulf of California. Salt is found all over the world, and it may be produced wherever there is ocean water that can be evaporated.

But all salt is not the same. The best test of the quality of a salt is its ability to preserve meat. To do this well salt must contain ninety-six per cent. chloride of sodium, and must be free from certain destructive elements.

The Mexican salt from Carmen Island while widely advertised does not fullfil the requirements of a good salt, because it contains lime. And when Carmen Island salt is used as a meat preservative it tends to burn up the tissue.

About ten years ago experts made analyses of the ocean water in the salt marshes on the Alameda and San Mateo shores of San Francisco Bay and found that it contained the desired high percentage of chloride of sodium and that the peat land of the great marsh districts was reasonably free from elements that would injuriously affect salt.



The Salt Works near San Mateo, California

So it came about that great salt industries were established on both shores of San Francisco Bay, that thousands of acres of salt ponds were laid out in dyked compartments, that hundreds of glistening white pyramids of salt became landmarks in the old marshland, and today almost all the best table salt used in California is produced on the shores of San Francisco Bay.

The land as originally secured was cheap, because it was then supposed to be worthless. The labor of Japanese converted the dreary brown waste into symmetrical square paddocks, each mirroring its little landscape. With the inrush of water at high tide certain of these ponds were filled and the water was allowed to stand for a year, the steady evaporation in that time leaving a briny solution containing fifteen to twenty per cent. of salt. Other ponds closer in toward the works were supplied with this solution. They were then left for the evaporation process to continue. In this way the shallower ponds became finally coated and re-coated with salt to a depth of several inches. When this had dried it was scooped up with large shovels into little piles, then trundled along the smaller dykes in big wheelbarrows, and finally loaded into trains of tiny cars to be conveyed to a point where a salt pyramid could be built.

When first piled the salt is damp and gathers dust from the atmosphere. It is sometimes a dirty gray or brown. But after this outer surface hardens and crystallizes to the consistency of a rock the rains wash off the surface discolorations and the pyramid comes out a gleaming white. So hard is the outer crust of the great mass that a pickax is necessary to break it. While in this state the pyramid is composed of coarse granules commonly called rock-salt. Finer grades of table salt are merely rock-salt subjected to a grinding process.

At the Leslie Salt Works, near San Mateo, the salt is piled by electric power supplied from the Pacific Gas and Electric Company's lines. The little salt trains come in along the dykes and dump their loads. An endless chain of little buckets carries the material to the top of the heap, and there men with shovels distribute it to produce the proper slope.

Electricity is also used to drive the motors in the works, where the grinding is done.

The accompanying illustration shows the salt works, a salt pile in the making, and one of the ponds where the bay water is left to evaporate and deposit its salt. A. R.

Sacramento's Building Boom

Only those who have visited Sacramento several times during the last three years can appreciate the remarkable building growth that has been steadily going on during that period. A year ago in the November number of this magazine a list was published of about a dozen different public or commercial improvements, aggregating $2,887,000. This included a $400,000 courthouse, a $225,000 jail, a $200,000 municipal building, and the new Sacramento Hotel, costing $500,000. Now comes another report giving a list of fifteen new buildings under construction and aggregating an expenditure of $1,058,000. Neither of these lists included private residences, of which Sacramento has had built in the last few years and is still building a surprisingly large number. Here are the fifteen buildings already referred to:—

Nicholus & Ruhstaller	$ 17,399
Nicholus Estate	85,000
People's Savings Bank	150,000
Federated Trades Hall	62,000
Anderson & Peltier	75,000
The Drs. White and Mr. Donnelly	135,000
Farmers and Mechanics Bank	200,000
California State Bank	125,000
Silva Bros.	13,500
H. S. Crocker Company	13,000
M. Hanrahan	49,700
Clara Diepenbrock	58,274
Consumers Ice Company	25,000
Mrs. Williams	24,300
Emma Klunie	25,000
	$1,058,173

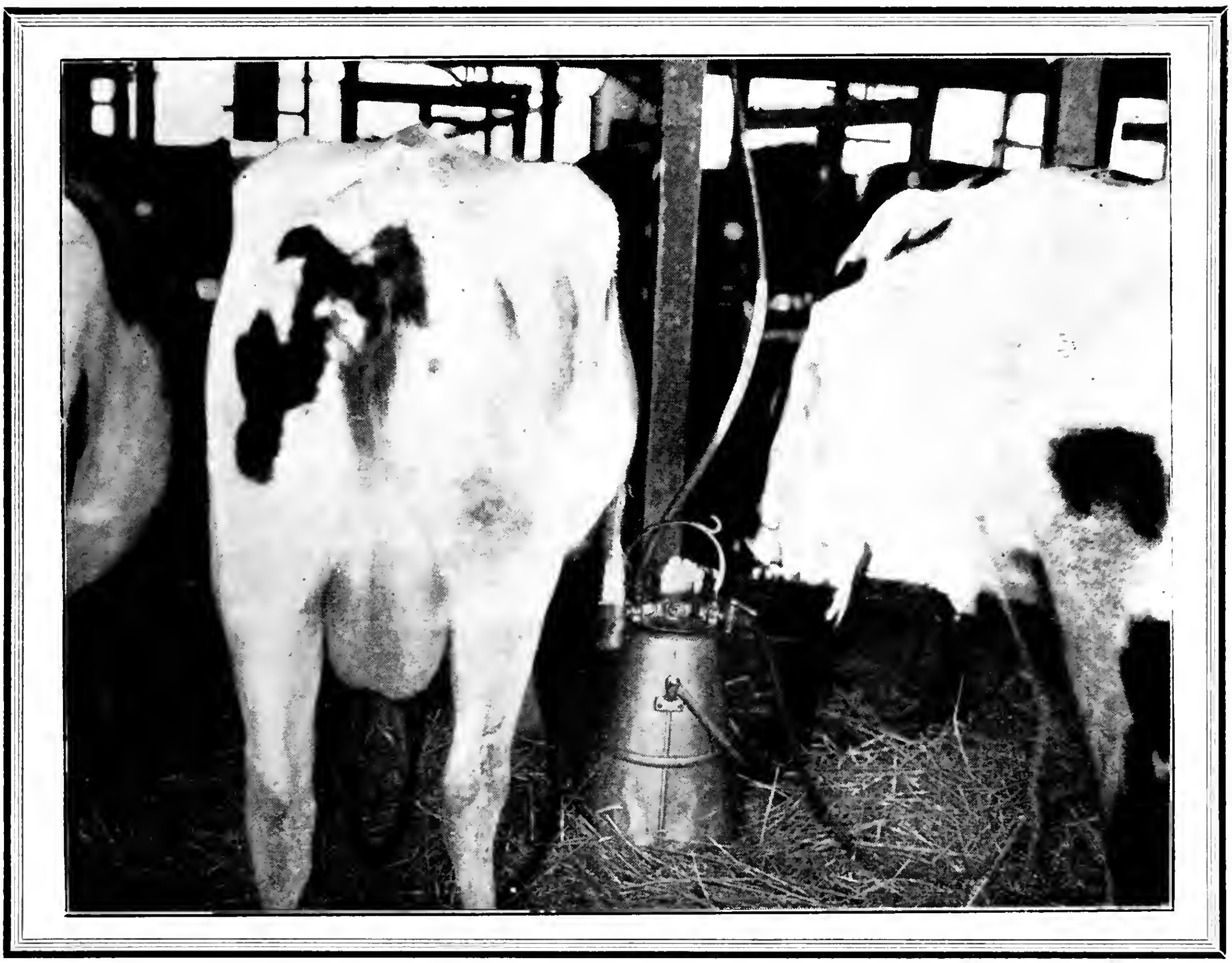
Milking by Electricity

THE application of electricity to the dairy industry is well exemplified at Alameda County's poor-farm, near the town of Hayward.

There half a hundred Holstein cows, comprising the dairy herd, are regularly milked by the use of electric appliances. Electricity, generated by the Pacific Gas and Electric Company's hydro-electric plants in the distant Sierras, is wired in to the cow-barns and dairy building to do the milking and operate the separators and churns, through the use of small intermediate electric motors.

One of these motors operates the vacuum-creating device which is the basic principle of the mechanical milker.

The cows are driven into the long barn and ranged on opposite sides, forming two long rows facing each other, with the fodder supply occupying the space between. Each cow's neck is then enclosed in a small perpendicular panel suspended from above and secured from below by a chain, allowing some little movement from side to side. Between the cows as they stand there are no stall partitions. But they stay where they are fastened, and eat the fodder that is in front of them.



Along the overhead beams are run the suction pipes to which the milking machines are attached. The milking process is not greatly unlike the method by which carpets are cleaned by the use of the now well-known vacuum cleaners. It is a suction process.

Between each pair of cows is placed the combination milk receptacle and vacuum pump, connected by hose with the overhead

vacuum pipe. From this pump there extends to each cow a small rubber hose having four terminal branches, each provided with a thimble-shaped rubber cup about the length of a man's middle finger. These rubber thimbles are attached to the cow's teats, where they hold securely by suction. The throb of the pump induces a succession of suction movements, and the milk can be seen pulsating through the glass tube as it enters the large receptacle. The softness of the rubber contact seems not to annoy even the young cows. One man is easily able to attend several machines, to see to their removal, and to the milking of the whole herd. Thus manual labor is again displaced. A. R.

Is Electricity Cheaper in the Kitchen?

THE relative advantages of gas and electricity as a kitchen fuel have been well analyzed in a letter herewith produced. It was sent by Frank A. Leach, the company's manager at Oakland, to S. V. Walton, the company's commercial agent. Alameda's municipal plant has reduced its rate on electricity for fuel purposes, and the newspapers have left it to be inferred that electricity at this new rate would displace gas in the kitchen. Here is the letter:—

We have your letter of November 9th, enclosing a clipping from the "Examiner" of the 9th inst., headed "Electric Cooking Made Worth While—Alameda Electric Commission Reduces Current Price from 7 to 4 Cents."

The article narrates that last year the Alameda municipal plant cleared $30,000 on the seven-cent rate, and by an increased consumption, due to this new four-cent rate, the Commission expects to clear $40,000 during the coming year.

The Commission claims that cooking with electricity at four cents will compete with the price of gas.

The proposition is, that a separate service connection will be made from the main line to the meter board, installing a separate meter, for $5 service connection charge. A separate transformer will be installed for this service, so as to take care of the increased load, and preclude fluctuations on the lighting service. Minimum charge for fuel service, $1.

An appliance store has been opened at the corner of Alameda and Oak Streets, under the name of "General Electric Company Appliance Store." This store has a full line of cooking, heating, and lighting appliances. We are unable to ascertain whether it has any direct affiliation with the electric municipal department or not. The lady in charge is the wife of an employee of the General Electric Company.

On display there are two complete cooking outfits, namely:—

No. 1—Electric cooking outfit, $140.
No. 2—Electric cooking outfit, 75.

These outfits will be sold on terms; no sales have yet been made. Heaters, irons, and lamps are meeting with some sale. Inquiry as to the cost of cooking by electricity produced the following table:—

Month.	Light, 7 cts.	Cooking, 4 cts.	Total.
Aug., 1909..	$1.45	$4.90	$6.35
Sept., 1909..	1.80	5.40	7.20
Oct., 1909..	1.55	6.65	8.20
Nov., 1909..	2.80	6.90	9.70
Dec., 1909..	4.40	6.44	10.84
Jan., 1910..	2.60	4.85	7.45
Feb., 1910..	1.95	4.45	6.40
Mar., 1910..	1.80	5.70	7.50
April, 1910..	1.20	4.60	5.80
May, 1910..	1.40	4.70	6.10
June, 1910..	1.55	5.45	7.00
July, 1910..	1.55	4.70	6.25
	$24.05	$64.94	$88.79

This was the actual cost in the home of the lady attendant. The family consisted of two, sometimes three, besides entertaining, etc.

The cost of their illuminating service is also shown.

The cooking expenses, as you will note, show an average of $5.50 a month. This is about double the average cost for such a family using gas.

The electric oven takes about 1,500 watts, and with two, average two-quart utensils on top of the stove, going at the same time, would make an average maximum consumption of 3,500 watts.

Under these conditions, a two-kilowatt-hour transformer would be the smallest installation to consider. This would, probably, entail a primary extension, so with this cost and that of the transformer and its incidental losses, there is not a very inviting proposition for the rate charged. From the consumer's standpoint, the rate is about 50% higher than gas.

One of our consumers has had an electric cooking installation for several years. A gas range is also installed. He states that the efficiency of electricity is about half that of gas. In other words, a two-quart kettle will require fifteen minutes to come to the boiling point, whereas on gas about eight minutes is required.

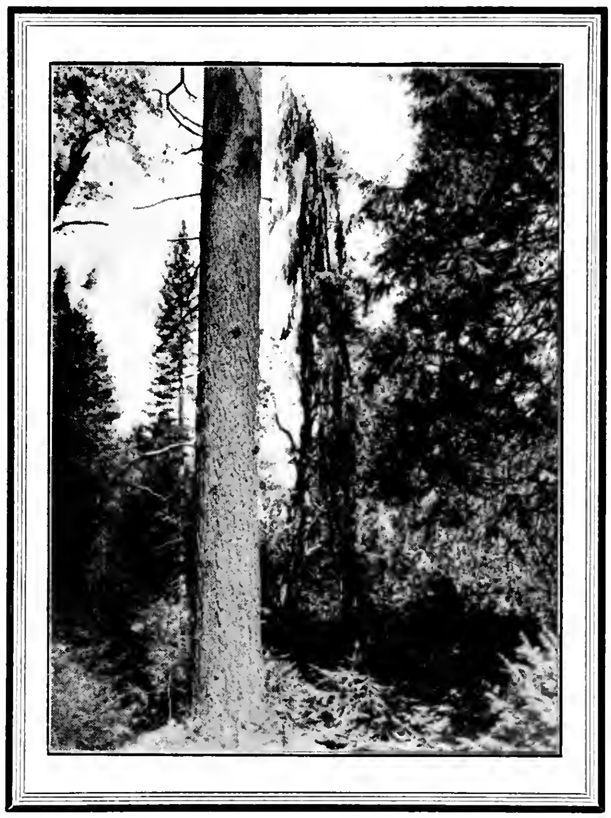
Electricity appeals to him and his wife from the asthetic standpoint, but as time is generally an important factor in his household, he finds gas being used the greater proportion of the meals. The family consists of four. His fuel electric averages sixty-four kilowatt hours a month, and his gas $4.20. The latter includes a Ruud heater, which averages about $2.25 a month. They seem to think that roasts are better when electrically cooked, because there is no contact with the gas or its odors. However, as in the process of cooking, meat excretes juice and steam and shrinks in weight, the process has been proven one of "throwing off"—excretive rather than absorbative. The difference, then, if any, is that the meat is cooked more slowly electrically, while with gas the same regulation is not given; otherwise, the results can be made the same.

Personally, we have given considerable thought to the subject for some years. We have been unable to formulate any attractive plan, remunerative to us or our consumers; hence we fail to see anything competitive against gas in this action of the commission. Some few of our gas consumers will take it up, like any other novelty.

C. R. Gill, superintendent of electric distribution in the Sacramento district, used to play end and halfback on the varsity for the Washington State Agricultural College.

A Weeping Fir Tree

In the Sierra forest adjacent to the Pacific Gas and Electric Company's Tiger Creek sawmill in Amador County, there is a remarkable tree. It is a tall, slender growth of about fifteen years. Its branches hang in lengths like trailing grape vines. Foresters say that no other tree of this kind is known to exist on the American continent. Its natural habitat is said to be Norway. How



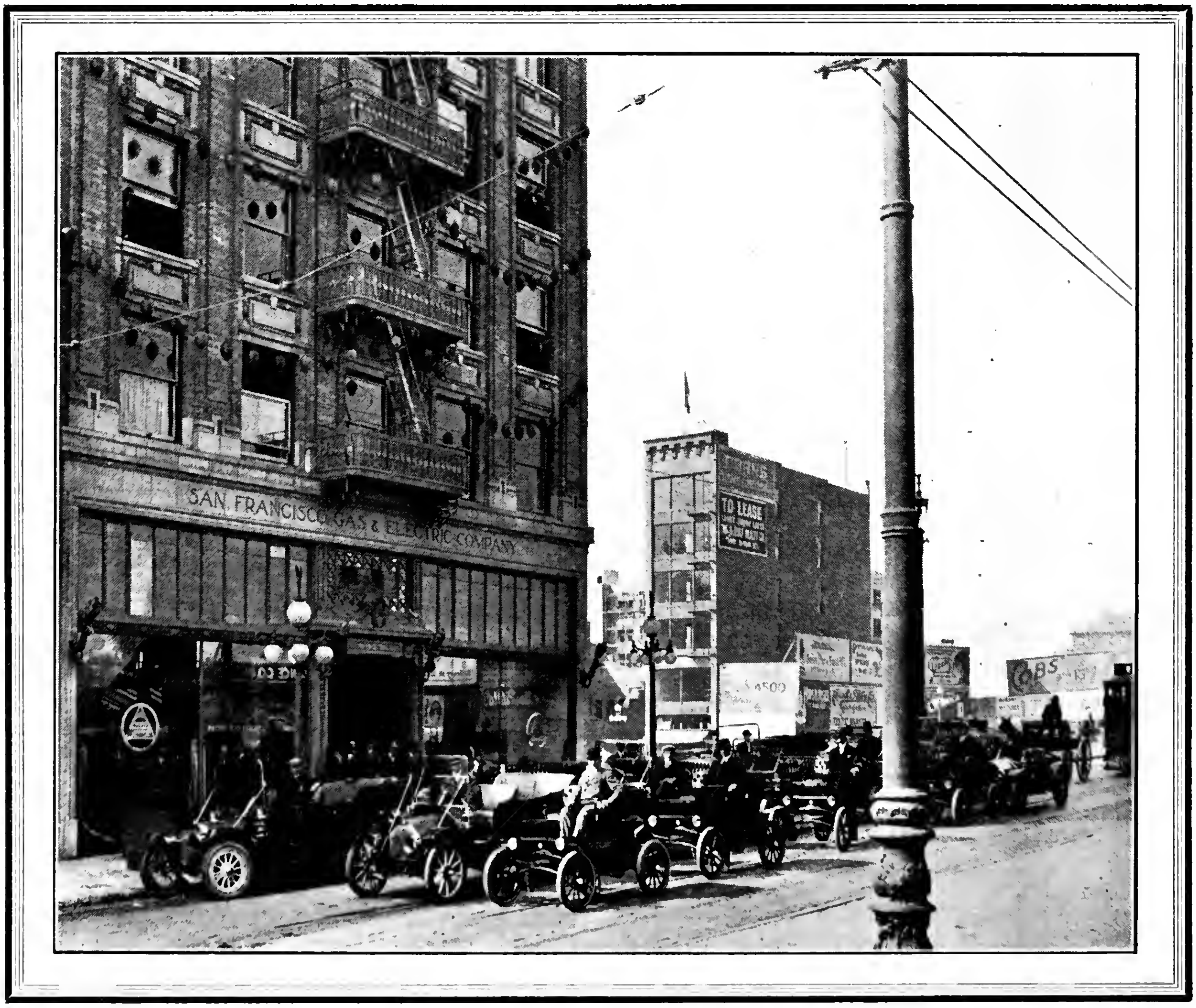
this isolated specimen happens to be growing in a remote spot of the California forest is a mystery. The lumbermen call this little tree "the weeping fir," because it looks like a fir but has trailing branches like a weeping willow. Years ago some idler ruthlessly whittled the bark all off the trunk, but H. M. Cooper, at that time in charge of the Tiger Creek sawmill, surrounded it with a sheathing of pine bark and filled in the intervening space with earth. This treatment saved the life of the tree and it is now growing sturdily. It is now about thirty feet in height.

The Company's Forty-Three Automobiles

SOMETHING of the magnitude of the territory served and the business done by the Pacific Gas and Electric Company is suggested by the fact that it has in this month of November, 1910, forty-three automobiles in regular use.

That is what it means to be doing business in twenty-six of California's fifty-seven counties, to be supplying light and energy to more than half the population of the state. The company has fourteen electric-generating plants, and from them it furnishes electricity through hundreds of miles of power-lines and about two hundred substations to one hundred and fifty-eight California communities. It has eighteen gas works, and from them it supplies gas for fuel and illumination in thirty-three cities. It owns half a hundred mountain lakes and reservoirs and a thousand miles of aqueducts, and from its water-storage and distributing systems, it runs eleven hydro-electric plants, delivers water to seventeen towns, and irrigates about 15,000 acres of orchards. It owns two lumber camps and sawmills to make its own lumber for its many miles of mountain flumes. It serves a territory two-thirds as large as all the New England states combined and three-fifths as large as the whole of New York state. It employs 3,500 people.

To keep this gigantic system in working order directing minds must be ever on the



Sixteen of the company's automobiles drawn up in front of the company's San Francisco headquarters building on Sutter Street

alert. There must be quick means of transportation.

Give the consumers service. That is the first consideration. Day and night that is the end in view. Engineers, managers, superintendents, experts must be on the alert to supervise on the spot whenever and wherever there is trouble threatening even a moment's pause in the unseen flow of electric current to cities, to factories, to agricultural districts; in the continuity of the gas supply, in the reliability of the water flow.

The company's field is one of magnificent distances. To make the rounds of its various properties would take any one person several weeks of constant traveling.

So automobiles are a necessity. They are distributed where road conditions permit their use and where experience shows they are most needed to avoid delays in the service and business of the system.

There are thirty-four gasoline cars, ranging from ten- to forty-horsepower each; five electric buggies from two- to four-horsepower each; and two electric trucks of five or more horsepower.

Twenty different automobile factories are already represented in the company's string of regular utility cars. Below is a list of the machines in use.

The company has issued an order requiring that a powder tube be carried conveniently on every one of its automobiles to be ready in case of fire about the auto. A. R.

FOR USE OF	PERSON	CAR	HORSEPOWER
Gas Dept., Oakland	F. A. Mulgrew	Autocar	12
Supt. Electrical Contracts, S. F.	F. S. Gray	Autocar	12
Dist. Mgr. at Santa Rosa	J. D. Petch	Buick	18
Redwood District		Buick	18
Dist. Mgr. Placer County	H. M. Cooper	Buick	18
Mgr. Stockton Water Co.	J. W. Hall	Buick	18
Asst. Dist. Mgr. Placer County	W. R. Arthur	Cadillac	10
Hydro-Electric Engineer	P. M. Downing	Cadillac	30
Engr. Elect. Distribution	S. J. Lisberger	Chalmers 1910	30
Genl. Mgr. S. F. G. & E. Co.	G. C. Holberton	Chalmers 1910	40
Mgr. Nevada Water District	Geo. Scarfe	Ford	24
Supt. Elect. Distribution, Berkeley	J. H. Pape	Franklin	20
Bookkeeping Department		Hudson Roadster	18
Dist. Mgr. at San Rafael	W. H. Foster	Inter-Auto	20
Supt. Substations in S. F.	J. W. Varney	Locomobile 1907	20
Dist. Mgr. at San Jose	J. D. Kuster	Locomobile 1908	20
Supt. Elect. Distribution, S. F.	H. L. Worthington	Locomobile 1908	20
Vice-pres. and General Manager	J. A. Britton	Locomobile 1909	30
Second Vice-pres. and Treasurer	A. F. Hockenbeamer	Locomobile 1909	30
Steam Engineering Department	F. H. Varney	Locomobile	40
Supt. San Jose Power Division	A. G. Ramsted	Mitchell	20
Elect. Distribution Dept., Oakland	A. U. Brandt	Oldsmobile 1907	20
Supt. Elect. Line Construction, Oakland	J. J. Gallagher	Oldsmobile 1907	30
Chief Engnr. Gas Department	E. C. Jones	Oldsmobile 1909	40
Supt. Gas Distribution in S. F.	W. R. Morgan	Oldsmobile 1909	40
Supt. Sacramento Power Division	J. O. Tobey	Overland 38	20
Supt. Gas Distribution in Oakland	Geo. Kirk	Overland 1910	20
(extra car)		Overland 1910	40
Dist. Mgr. Solano County	C. E. Sedgwick	Overland	40
Supt. North Tower Power Division	C. D. Clark	Peerless	30
Supt. Sacramento Power Division	J. O. Tobey	Peerless	30
Supt. Oakland Power Division	W. Hughes	Peerless	30
Dist. Mgr. at San Rafael	W. H. Foster	Rambler	40
Dist. Manager at Redwood City	I. H. Newbert	Stearms 1909	15–30
District Mgr. at Oakland	F. A. Leach, Jr.	Stevens-Duryea 4	20
Elect. Distribution Record Dept., S. F.	C. E. Larrabee	*Baker Imperial Buggy	2
Steam and Gas Engnr. Dept.	W. S. Hyde	*Baker Imperial Buggy	2
Elect. Distribution Dept. in S. F.	A. J. Theiss	*Baker Imperial Buggy	2
Inspector Steam Plants	R. N. Miller	*Baker Imperial Buggy	2
Dist. Mgr. at Sacramento	C. W. McKillip	*Columbus Runabout.	4
San Francisco Peninsular Towns		*Walker truck	5
San Francisco		*General Vehicle truck	6

* Electrics.

Accepts Better Position

HARRY LEE WORTHINGTON, whose recent withdrawal from the San Francisco Gas and Electric Company's service is regretted by all who were associated with him, came to California in 1891 from Kentucky, his native state.

H. L. Worthington and Foremen of Electrical Distribution, San Francisco

Top Row (Left to Right)—Willweber, Carlson, E. S. Jones, Cameron, Marshall, Sullivan; Second Row—Dahla, Dowd, Frye, Counihan, G. Carroll, Riter, Desmond; Third Row—Hatfield, Boden, Worthington, Keefe, Bogan, S. Moore; Bottom Row—Thurston, Plotner.

He took up the work of electrical construction for several employers in succession, and in 1899 had charge of the linemen on the transmission line of the Bay Counties Power Company from Colgate to Oakland. He left the employ of the State Board of Harbor Commissioners at San Francisco to enter the service of the company in the early part of 1907, with the title of general foreman of the electric distribution department, which position he resigned October 31st, 1910, to engage in a more diversified field of energy distribution.

The esteem in which he is held by employees and officials alike found expression at a farewell banquet tendered him by his fellow-employees on the eve of his resignation. Upon this occasion a beautiful and valuable gold watch and monogram fob were presented to him by his subordinates.

Besides the one hundred and eleven fellow-workers assembled to honor their guest, there were present by invitation George C. Holberton, S. J. Lisberger, A. R. Thompson, and A. J. Theis.

When the banquet had progressed as far as coffee and cigars, General Manager Holberton of the San Francisco Gas and Electric

Company read the following letter from the president of the company, and then, in the name of the donors, presented their guest with a souvenir watch and fob:

To the Employees of the Distribution Department,
San Francisco Gas and Electric Company.

I beg to acknowledge receipt of your very kind invitation to attend the banquet tendered to Mr. H. L. Worthington, on his retirement from the company, to be held this Saturday evening, and regret exceedingly that a previous engagement will prevent my attendance. I can not, however, let the occasion pass without saying to you, and through you to Mr. Worthington, such things as I might have said at the banquet board.

No one in the company more deeply regrets the resignation of Mr. Worthington than I do. He has, in my judgment, made good in his department, and has created and perfected an organization which is a credit alike to himself and to the men chosen by him to do the work of the company.

There are two things that go to make up success in any department of life: one is a knowledge of and obedience to discipline, and the other is loyalty. Mr. Worthington has shown himself to be the possessor of both of these qualifications. He has not only been amenable to discipline, but has, by reason of that trait been able to exact discipline from others. His loyalty to the company has never been questioned. He stands as a good example to all men wherever employed and who hope for success. No man should work for another one unless he can give, during his time of work, his whole best interest, his intelligence, and his strength to those for whom he works. Their interests should be his, and the betterment of his own should be his one prevailing thought. This constitutes loyalty. The opposite of this condition must, of necessity, constitute more or less of disloyalty, which is neither fair to the man nor his employer. The San Francisco Gas and Electric Company, as a corporation, is just as much in need of help and helpful counsel from its men as a man is in need of the same kind of aid from his associates. As the president of the company, I want each man to feel that he has friends in the executive officers, and that such officers are keenly alive to the necessity for cultivating their men and for doing for them that which they consistently can in helping them to build better for the future.

Mr. Worthington leaves the company with the best wishes of every one in it, carrying with him an appreciation for what he has done and the hope that in his new work he will fully realize his ambition.

Very truly yours,
John A. Britton,
President.

After many appropriate and witty remarks had been made by S. J. Lisberger, H. J. Doherty, and others, all present pressed forward to exchange hearty hand-clasps with their retiring chief, and with the officials.

Those present were:

City Foremen—Keefe, Boden, Bogan, S. Moore, Hatfield; Underground Gang Foremen—Carlson, Dahla, E. S. Jones, Dowd; Overhead Gang Foremen—Marshall, Plotner, Cameron, Desmond, Sullivan; Service Foremen—Thurston, Riter, Counihan, Carroll, Frye; and Colberson, A. Smith, Sawdrey, Woodward, Robinson, Hughes, Steininger, Rodgers, Cummings, Smith, McManus, Danielson, Doherty, Kennard, Kane, James A. Britton, H. Moore, Urbais, Fenton, Turriaga, Deleney, Stevens, Kammerer, A. J. Smith, Tobitt, Fraser, Ford, Nichols, Grigsby, Sterling, Tyson, Penders, Scott, Barman, E. W. Jones, Millikan, Bailie, Davidson, Honan, Badger, Calvin, Hawes, Murphy, Madden, O'Connell, Mathews, Britt, Perry, Ewald, Clark, Jeffray, Chisholm, Brown, Dever, M'Leod, Finnigan, Taylor, Nelson, Bubar, Cullen, Trowbridge, Walker, G. Smith, Horton, Coyle, Davis, McInerny, Thatcher, Gleason, J. B. Doherty, R. Jones, Roberts, Cooke, Furlong, Sollberg, Flatley, McArdle, Skoog, Schafer, Mills, Hilton, Thomsen, Rohrer, Nickel, Bacigalupi, Sharpe, Nathanson, Piper, Clyne, E. Moore, Bigelow, Bailly, and the invited guests.

F. J. S.

Nine unison telemetric pressure gauges are in daily use by the Brooklyn Union Gas Company, Brooklyn, New York.

Announcement has been made that with the beginning of the new year Placer County water district will be divided into two parts, and James Martin will be in charge of all that area northward of and including the town of Colfax and embracing the Bear River Dam. In the matter of water sales he will act independently, but in all questions affecting the supply of water he will act in conjunction with H. M. Cooper, who will continue in the management of the Pacific Gas and Electric Company's South Yuba water system from the town of Colfax southward.

Pacific Gas and Electric Magazine

PUBLISHED IN THE INTEREST OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - - - - - EDITOR
ARCHIE RICE - - - - - - - - - EDITOR
A. F. HOCKENBEAMER - - - BUSINESS MANAGER

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EDITORIAL

Where We Fight Ourselves

Worry is dread that some particular thing or things will occur. The calamity has not yet happened, but the thought persists that it may come. So worry is apprehension created by the imagination.

This little article is not written simply to admonish, "Do n't Worry." It is an attempted analysis of the reason and the relief.

Most of us worry and will continue to worry at times.

" 'Tis more blessed to give than to receive" could have referred to advice. It is always being given, but rarely being taken.

Some philosopher has said that if you can prevent a thing nothing is to be gained by worrying about it, and if you can not prevent it then you are obviously foolish to waste mental energy upon it.

When the mind is persistently possessed by apprehension of some coming evil that condition is called worry. People of meager brain power do not worry. Worry is a product of an active brain, the evidence of imagination, of intelligence.

It is a mental state induced by imaginary dire developments. So its cure lies within the mind that creates it.

Those having intelligence enough to worry have sense enough to stop it if they will. By putting the same amount of mental energy into calm analysis and sensible planning on that subject or some other and thinking consistently the old dominating dread may be crowded out.

The cure is a process of creating a useful thought to replace one that does no good.

If you can avert something that is worrying you, go about it. Physical inaction is one of the conditions that make for an anxious mind. Hearty exercise draws blood to other parts of the body and relieves the tension on the brain. A sudden insufficiency of blood to the head is what causes fainting. Too much blood to the brain produces the opposite of unconsciousness, and that feverish condition is our old fighting friend Worry.

When we are anxious or afraid, the brain is actively possessed by the thought, and it is using an extra supply of blood. At such times we literally do have cold feet, as less blood reaches the extremities.

Worry wears more than work.

Physical labor tires, but nature takes her toll by enforcing restful sleep.

When the mind is active, when worry dominates it, sleep does not come.

Thinking keeps drawing an added blood supply to the brain, and as long as the brain is working at high tension and taking that extra volume of blood there can be no sleep.

Probably nine-tenths of the worries that beset us never do develop into realities. The whole process is wearing, profitless, and a reproach to the intelligence of the mind that permits it to gain and keep a hold.

Worry is the black monster-child of a gloomy imagination. But it can not survive in the light of a sanitary nursery, wherein a healthy white child has been placed.

Apprehension, anxiety, dread are all like sand in the bearings of valuable machinery. They impair usefulness, lessen efficiency, destroy material, and they never do any good.

In some great corporations this liability to depression is so well recognized that efforts are being made to surround the employees with dwelling and operating conditions that

will relieve tendencies that might lessen the element of mental buoyancy and impair the effectiveness of the individual.

Imagine ten thousand engineers of passenger locomotives and every one of them badly worried by something apart from his work. Might not such a condition easily increase the possibility of accidents and loss of life? Imagine a thousand operatives at electric stations, and each one of them preoccupied with private worries. Think what might result in dangers on the lines and to the machinery.

Worry is a self-created useless opponent who impairs our strength to fight what is really worth fighting for.

Improvements In the System

A twenty-inch well has been authorized for Stockton.

Oakland gas works is adding four new purifiers.

Vallejo is to have four new 12 x 12 x 5-foot purifying boxes.

Additional water mains are being laid in the town of Colfax, Placer County.

Oak Park lighting district in Sacramento has ordered twelve arc lamps installed.

Underground District No. 2 in Sacramento calls for an expenditure of approximately $40,000.

A 10,000-volt line has been authorized from Cache Creek to Knights Landing, to supply reclamation districts.

At Vernon, on the north bank of the Sacramento River, the wood mast carrying high-tension circuits is to be replaced by a steel mast.

A 4,000-volt line is being built from Pacheco to Walnut Creek in Contra Costa County.

Increased power demands necessitate building a substation at Smartsville, Yuba County, on the Bay County line.

A storage battery housed in the new building is being installed at Station I at Eighth and Mission Streets in San Francisco.

A 4,000-kilowatt, 60-cycle, synchronous motor is being installed at North Tower to act as a regulator on the high-tension lines.

A new 12,000-kilowatt General Electric Curtis turbine generator will be in operation at Station A, San Francisco, December 1st.

Grass Valley and Nevada City, formerly operating at 133 cycles, are now being cut over to 60 cycles to make the entire system uniform.

An electric truck with a carrying capacity of three and a half tons has been ordered for the general distribution service in San Francisco.

Duncanson and Harrelson have a contract for the foundation for a new 5,000,000-cubic-foot holder at the Potrero gas plant in San Francisco.

MEN OF THE COMPANY

ORESTA EUGENE CLARK

Civil War Veteran, Mayor of a Michigan town, and for the past eleven years Manager at Napa.

"MARCHING through Georgia!" Here is a man that did it. He was with Sherman when that army of devastation made a vast zone of ruined fields and farm houses clear across the southland to the sea.

He was born in Erie County, New York, in 1844. That makes him sixty-six years of age, but the years have not made him an aged man. He is big and robust and hearty-looking.

When the Civil War broke out he was seventeen, and he enlisted with the First Michigan Engineers. He had spent his boyhood near Grand Rapids, Michigan. His experience as a soldier covered a period of four years and two months and continued from the beginning until the end of the war. His regiment was attached to the Army of the Cumberland, until it was finally assigned to Sherman's command.

At the close of the war he returned to Kent County, Michigan, and in 1869 was married there. He was mayor of Rockford, Michigan, two terms, being first elected to that office at the age of thirty.

O. E. Clark

In 1879, when he was thirty-five, he moved to Colorado and engaged in mining and his profession of civil engineering. Eleven years later he moved to California, and, in 1890, for the Thomson-Houston Company, he established at Napa the first electric light plant in that city. And for the first two years after its completion he managed the electric business there.

He was then, at the age of forty-eight, called to the San Francisco office of the General Electric Company, and for six years was a traveling agent for that concern throughout all the territory west of the Rocky Mountains.

In 1898 he was sent back to Napa to be again manager of the electric plant that he had built. In the following year that old steam plant at Napa was purchased from the General Electric Company by Doctor Thomas Addison, coast manager of the General Electric Company, and John L. Howard. These two men at the same time also acquired the Napa gas works from the George E. Goodman bank people. The gas

and electric enterprises at Napa were then amalgamated into one company, and O. E. Clark was retained as its manager.

Three years later, in 1902, the Napa gas and electric business was bought by the California Central Gas and Electric Company, one of the predecessors of the Pacific Gas and Electric Company of today. And O. E. Clark is still the manager at Napa.

He is a member of the Masonic order, and has been for thirty-two years, is a member of the United Workmen, and is an Elk. Also, he is the father of one son, at present a resident of Alaska.

A little more than a year ago O. E. Clark suffered a peculiar injury to his left eye. He awoke suddenly in the night in great pain, and discovered his eye and forehead swelling. The occulists informed him that it was a nervous affection that had killed a set of surface nerves surrounding the eyelid and spreading up over the head. "They said," remarked O. E. Clark recently, "that nature might in time absorb the dead nerve and produce a new one. I am a pretty tough old nut, and I guess I 'll get back my sight. I can already distinguish light with my left eye."

A. R.

Joseph J. Walsh

In Memoriam.

DURING the late afternoon of November 17th Joseph J. Walsh, the superintendent of the San Francisco Gas and Electric Company's collection department, passed to his last home after a lingering, though not painful illness covering fully a year. The particular cause was valvular heart trouble. He was born in San Francisco, September 19th, 1865, and was therefore forty-five years of age. Because of his sterling character, his honest nature, his loyalty to his friends and his innate cheerfulness, he will long be remembered by his associates, who held him in great esteem. By the company he was rated a zealous, honorable, and loyal employee.

"Joe," as he was familiarly called, entered the employ of the Pacific Gas Improvement Company, one of the predecessors of the San Francisco Gas and Electric Company, about June, 1883—twenty-seven years ago—and filled successively the positions of service man, meter man, office man, collector, and, finally, at the time of his death, superintendent of collections. A little story indicating "Joe" Walsh's idea in handling his men comes to mind at this writing. One day he received a call from a newly appointed manager of collections of another of San Francisco's big public-service corporations, who, in the course of conversation, said that he had heard that Walsh had his

men pretty well in hand and asked how he accomplished it. "Well," said "Joe" Walsh, "get them so they'll call you 'Joe' and treat 'em like white men and they'll work all right."

Many years ago, before he entered the service of the gas company, "Joe" Walsh was a San Francisco fireman. He was one of three firemen who fell from a broken ladder at Bush and Hyde streets, his two companions being fatally injured in the crash.

Besides the widow there are left two daughters, Marian and Ethel Walsh, to mourn his loss. The two young ladies occupy clerical positions with the San Francisco Gas and Electric Company. C. L. B.

Industrial Items

The Davis and Farnum Manufacturing Company of Waltham, Massachusetts, is erecting a gas holder for the Oro Water Light and Power Company at Oroville, California.

Patrick Goodman, inventor of the Goodman Stopper, made by the Safety Gas Main Stopper Company, of New York, was formerly foreman of the street-main department of the New York Consolidated Gas Company.

La Porte, Indiana, is a picturesque middle-west town of about 30,000 people. One feature of which it is exceedingly and justly proud is the fact that more than eighty per cent. of its homes are owned by workmen employed in its various factories, which include the La Porte Carriage Works, the La Porte Braiding Mills, and the La Porte Gas Meter Company.

Rotary station meters each having a capacity of 360,000 cubic feet, have recently been installed by the Pacific Gas and Electric Company at its gas works at Chico and at Santa Rosa.

The gas company at Glassboro, New Jersey, is having a new plant built by the Gas Machinery Company of Cleveland. It includes two eight-foot-six-inch water-gas sets.

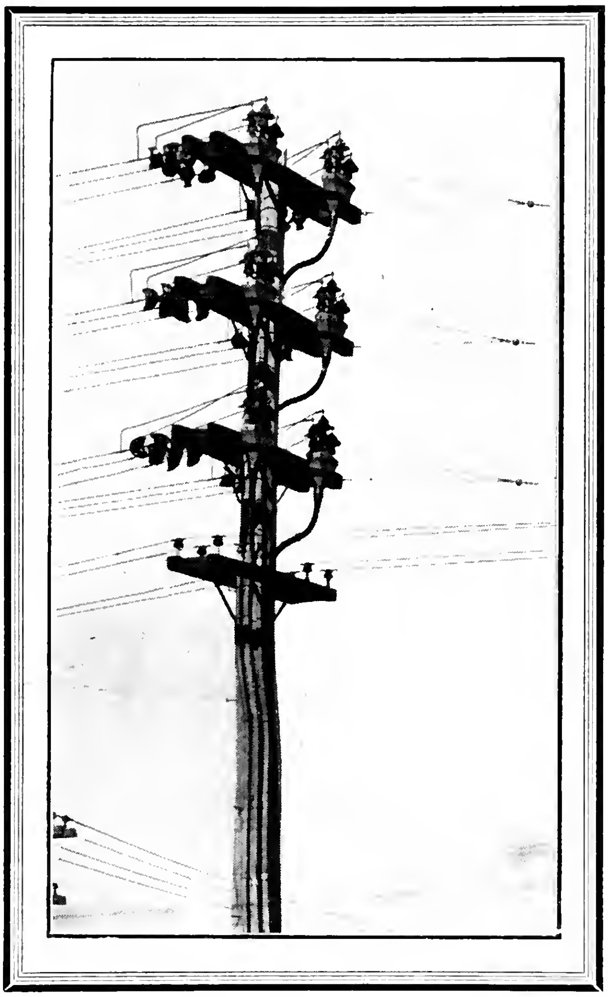
The Safety Gas Main Stopper Company has just patented a new locking device to prevent the stopper from slipping in mains coated with tar or oil, or from a jar or hammering on the main, or something accidentally dropping from the bank. It is a lock which holds both handles in place so that when the stopper is once in position it can not be disturbed until the screw is released.

The 114,720,697,200 cubic feet of gas which is being measured annually in this country alone by Rotary Meters is a vast percentage of the country's gas product. Its vastness will be appreciated when the statement is made that 114,720,697,200 cubic feet of gas represents more gas than is made yearly in the cities of Greater New York, Chicago, Philadelphia, Boston, St. Louis, San Francisco, Detroit, Newark, Baltimore, Los Angeles, Milwaukee, Washington, Providence, Louisville, Rochester, Indianapolis, Minneapolis, Denver, St. Paul, Grand Rapids, Portland (Ore.), New Orleans, Omaha, Buffalo, Hartford, Des Moines, Albany, Pittsburgh, Utica, Cleveland, Columbus, Dayton, Troy, Augusta, Toledo, Houston, Harrisburg, Binghamton, Portland (Me.), Dallas, Fort Worth, Galveston, Westchester County (N. Y.), Montreal, Toronto, Quebec, and all the rest of Canada.

A Unique Pole-Line Construction

ONE of the troublesome problems incident to high-tension distribution is the connection between the overhead lines and the underground system. This is especially true where a large number of conductors must be taken care of in comparatively little space.

E. B. Ellicott, electrical engineer of Chicago's sanitary district, has designed a method of connection which is highly satisfactory. As will be seen from the illustration, it occupies a comparatively small space but at the same time insures a high factor of safety.

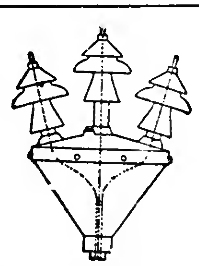


The installation illustrated herewith takes care of six 12,000-volt, three-phase lines. It is one of several that have been in successful operation for the past fifteen months.

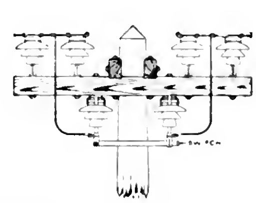
The pot heads are entirely weatherproof. They are mounted directly on the cross-arms without housings. This method not only simplifies but decreases the cost of installation.

The porcelain insulators are of special design, having a continuous passage, in which is located a hollow steel pin lined with treated wood. Means are provided for effectually sealing the insulator cones against the entrance of moisture. The supporting case is of iron or aluminum, as desired, and is provided with a metal chamber arranged to be filled with insulating compound. The lead-covered cable enters the bottom of the chamber and the three high-tension lines leave at the sealing cones of the insulators.

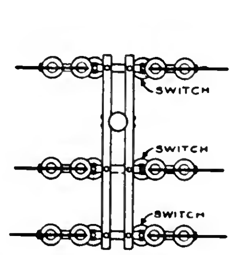
Where it is necessary or desirable to provide means for absolutely disconnecting the lines a set of disconnecting switches can be mounted on the same pole or on the one next in line, thus effectually killing the circuit for inspection and repairs. The switch is supported by means of two bolts passing through the cross-arms and opening downward in the usual manner. When closed the blade auto-



Showing internal connection.



Weatherproof disconnecting switch on pole.



Plan view of pole, cross-arms and switches.

matically locks in position, preventing danger of accidental opening or falling out. The device is so adjusted that approximately fifteen-pounds pull is required for opening it.

The design is such that the warping of the cross-arms will not affect either the closing or opening operations, as the switch jaws are so formed that the blade will make contact even though the cross-arm is considerably out of alignment.

In both pot head and switches for 12,000-volt service, the insulators are designed to withstand a line pressure of 25,000 volts and a test pressure of 70,000 volts. This ensures a high factor of safety. A complete line of switches is also manufactured for all voltages up to 60,000, thus covering a wide range of requirements.

These devices are being marketed by the Delta-Star Electric Company of Chicago, Illinois, and handled by their western representative, Van E. Britton of San Francisco.

Ah Charley, Cook

"I BE Lectra plitty near one year hop. I be DeSlabla two year hop. I be Colgate, Dee Cleek, Centville—all same. Work company eight year now. I quit one time—go work Glate West Plower Company. But come back."

So Ah Charley summarized his experience at five of the most important hydro-electric plants in the mountains of California.

If you have not heard of Ah Charley it is because you have not visited the mountain power plants of the Pacific Gas and Electric Company.

By the superintendents he is rated as the best Chinese cook in California. From time to time the request is made: "Send me a cook like Ah Charley." And the reply goes back, "There are no more cooks like Ah Charley."

"Once Ah Charley did train up a mighty good cook," said a superintendent. "He was a fine cook all right, but Ah Charley can run a boarding-house three hundred dollars a month cheaper than he can."

When Ah Charley was at the De Sabla power house he got some hogs in order to consume the scraps from the boarding-house table. He not only provided enough pork for the use of the boarding-house, but he sold hogs enough to create a profit of nearly three

Ah Charley and his Assistant on the porch at Electra

hundred dollars a year, which he turned into the boarding-house fund.

Round the boarding-house he is a jack-of-all-trades. He carries his own screw-driver and pliers, attends to the renewal of all the elecric lights in the building, and makes necessary repairs in the wiring. In his big kitchen at Electra he has a small motor equipped to run a churn and makes the butter for the boarding-house. In this churn he also operates an iced-cream freezer during the hot summer months. He has his room in a small

building near the boarding-house. He made the neecssary connections and wiring to light his own quarters, and the men at the plant say he did a good job. He had no 110-volt line, so he wired the 220-volt in series and put on 110-volt lamps.

Ah Charley has a little alfalfa patch of his own, near the club-house. He is cook, electrician, farmer, and boarding-house statistician. He keeps a month by month, minute tabulated record of the itemized cost of boarding the men and of every guest who comes to the table.

It is Ah Charley's ability as an ecomomist, as well as his skill as a cook, that makes him almost a licensed autocrat in his field. He runs the boarding-house, and he does his work, and he has little hestitancy in telling an official when the boarding house needs something, or in rejecting what he thinks is n't good enough for the place.

He will talk to you intelligently on just what are the strong points and the weaknesses, as he considers them, of the different big plants where he has worked as cook.

A subject dear to his heart is "Misa Blaum," meaning Frank G. Baum, formerly general superintendent of the Pacific Gas and Electric Company. And he will proudly show you a gold watch and fob presented to him by Mr. and Mrs. Frank G. Baum when they left Electra.

"I gettem wife China. I mally him thirty-three year go. Sometime go back China."

A. R.

The Safety Gas Main Stopper has been awarded prizes at every exposition at which it has been shown.

Yellow cross-arms indicate voltage in excess of 500 volts, and are generally termed "primary arms." Red cross-arms are used for lower voltages, those less than and including 500 volts, and are generally known as secondary arms."

A Romance in the Building

Miss Edith Stadtfeld of the addressograph department was given a surprise party at the home of Miss Genevieve Wells, 4252 Twenty-fifth Street, San Francisco, the evening of October 9th. The occasion was in

Miss Edith Stadtfeld

the nature of a congratulatory gathering planned by the young women of the addressograph department, following the announcement of Miss Stadtfeld's engagement to William A. Cavanaugh, a bookkeeper in the San Francisco Gas and Electric Company.

One of the features of the evening's amusement was the reading of some twenty criginal stanzas by Mrs. Lucie White, who analyzed those present in rhymed couplets.

The De Bataafsche Petroleum Maatschappij of The Hague, Holland, has recently purchased from the Chaplin-Fulton Manufacturing Company of Pittsburg a number of duplex governors which are to be installed in the island of Java.

Electricity Applied to Paper-Making

CONTRA Costa is the foremost manufacturing county of California. But comparatively few people know this. It has the largest oil refineries in western America, the second largest dynamite factory in the world, the largest smelting and lead works on the Pacific coast, a very large copper smelter, a big sugar refinery, powder works, rubber works, a big paper mill, and numerous minor industries scattered along or adjacent to its extensive bay and river frontage.

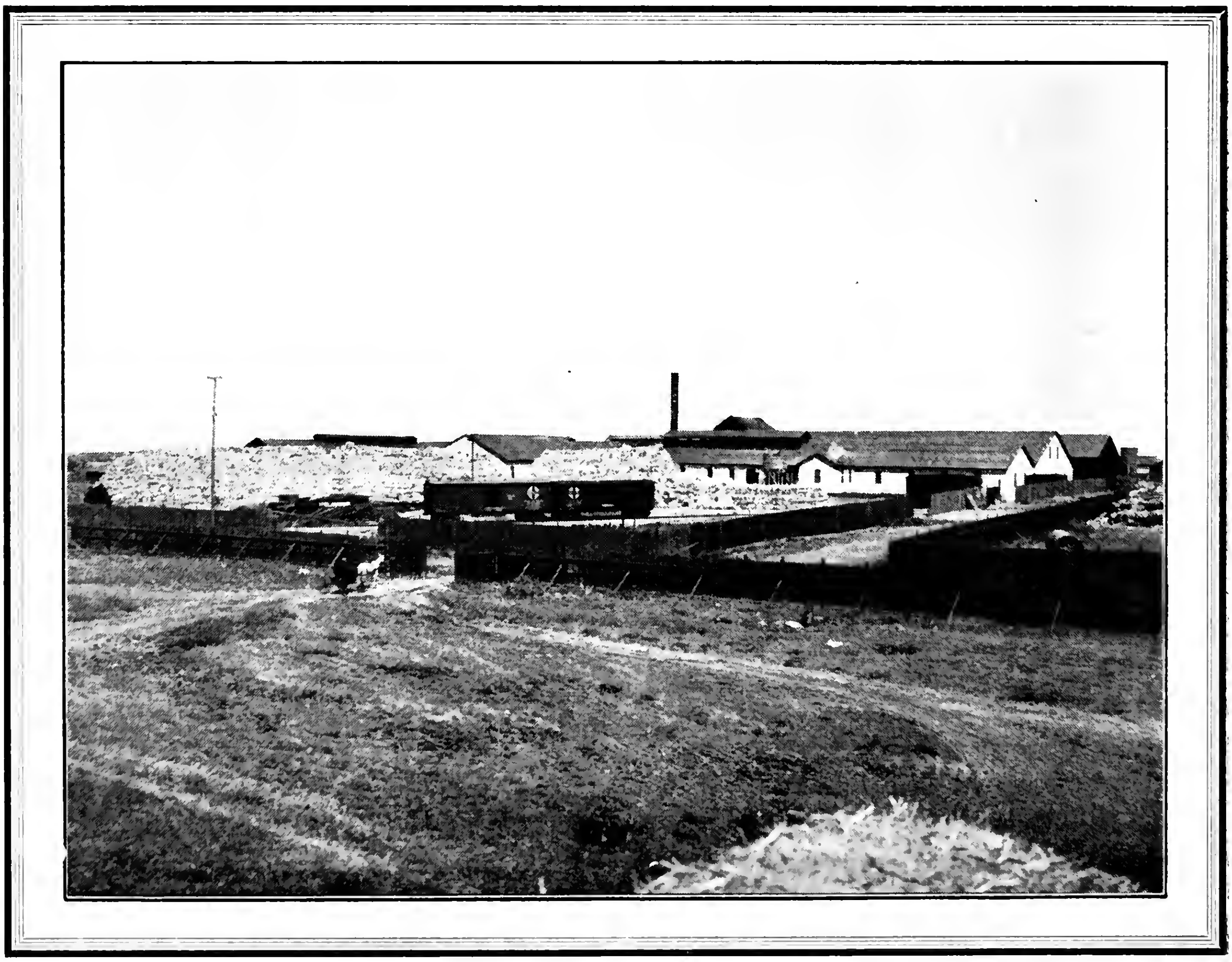
The town of Antioch stands on the bank of the San Joaquin River, near where that stream empties into the upper reaches of San Francisco Bay. Close to Antioch is the plant of the Pacific Paper and Board Mills. It is the only concern of its kind on the Pacific coast, and supplies the western territory as far eastward as Salt Lake City.

In the operation of this paper factory electricity from the lines of the Pacific Gas and Electric Company is used to drive forty motors, ranging from 5-horsepower to 400-horsepower each. Most of the motors are from 50- to 75-horsepower.

The factory employs one hundred and twenty men, and produces an average of from thirty to forty-two tons of paper a day.

Its principal products are pasteboard of various thicknesses, wrapping paper of different kinds, tissue paper, and straw-board used for egg cases.

The raw material for these products looms high in imposing pyramids in the yards adja-



Pacific Paper and Board Mills Plant, near Antioch, California

Two of the 2,000-bale pyramids of old paper to be made into new

cent to the works. One pyramid of recent construction consisted of some four thousand bales of wheat straw hauled in from the grain fields of Contra Costa County. Two other pyramids each contained about two thousand bales of old paper of nearly every conceivable description. Another pyramid consisted of bales of old jute sacks, twine, fragments of burlap, and similar material. Then there were a half dozen great piles of old copies of the different San Francisco newspapers, eastern magazines, discarded telephone directories by the thousand, and heaps of circulars and placards that had never been used. Also there were large quantities of cottonwood timber, to be crushed to fibre and later soaked into plastic pulp.

The cottonwood fibre, or wood fibre, as it is commonly called, is the basic principle of the heavier tough papers having a parchment-like texture.

In the process of making paper there are some seven stages through which the substance passes while being converted from old scrap paper into smooth new stock. Ordinarily it takes six hours for the evolution from scrap heap to stock pile. A longer time is required in the making of strawboard for egg boxes and in the production of tissue paper, as the pulp for these two products has first to undergo a cooking process. Also, before the old burlap, jute, and twine can be converted into pulp it is washed and treated chemically to remove foreign matter.

The pulp condition is the first stage in paper-making. Great vats are filled with bits of old paper and the mass slowly and steadily revolved until it assumes the consistency of a soft mush. This mush is drawn off in pipes and allowed to flow upon an endless blanket. This blanket is one hundred and twenty-two inches wide, one hundred and twenty-two feet

long, and made of the finest wool. It passes over and between large spool-like drums. The pulp accumulates like scum on a mill-pond, steadily assuming homogenity, closeness, and a uniform thickness to the width of the blanket, one hundred and twenty-two inches. As the water is gradually pressed out and the film of paper assumes consistency it is separated and passed on through other sets of rollers, drying in transit over big brass drums, and finally smoothed and ironed between highly polished, chilled-steel cylinders.

Paper is made in an unending strip, or ribbon, one hundred and twenty-two inches wide, with a deckeled edge where it reaches the sides of the blanket. While the completed end of the paper is coming out of the ironers and being cut into the desired lengths, not two hundred feet back on the ribbon the substance is only a very thin, soft scum without power to hold together unsupported.

As different grades of paper are required the lot is evolved in one long ribbon. And when the next order takes its turn there is a blending of the two grades or shades of paper at that point. But the ribbon goes right on, passing from one stage to another, without a break. Today a thick gray board to be cut up to form the covers of school books, tomorrow a thin, tough, yellowish paper to be used in wrapping packages in stores.

Tissue paper is made in the same long ribbons and of the same huge width, and then cut up into the sizes desired.

Ordinary paper in its completed form is subjected, in the factory office to three tests: (1) To determine its tensile strength; (2) to determine if it have the desired weight; (3) to determine if it have the desired thickness. The tensile strength is tested by means of a remarkably sensitive little instrument using air pressure upon a portion of the paper about the size of a dime. This pressure is gradually applied until the paper bursts, and the instrument records the pounds pressure attained. For instance, tissue paper can stand a pressure of about four pounds to the square inch, while some of the wrapping papers can take considerably more than one hundred pounds, and the thick, slate-colored board can withstand a pressure far beyond the power of the instrument to record. Tensile strength proves the toughness of the fabric, and the other tests, for weight and thickness, insure uniformity in the particular grade of paper called for by the contract.

In the operation of all machinery necessary for the production of paper in this plant electricity is the motive power. A. R

Archie Rice has resigned as manager of the publicity department and as editor of the magazine. He has been forbidden to use his eyes even for ordinary reading until they may with care be cured of the effects of a long nerve-strain.

George Salzgebler, patrolman and operator at Herdlyn, was recently made honorary mayor of the little town of Herdlyn in the San Joaquin delta country. During one of the big floods Salzgebler worked steadily for two days and three nights without sleep, directing his men in the restoration of the power-line.

O. F. Welling, foreman of the street-main gang of the Oakland Gas Light and Heat Company for the past twenty-one years, resigned his position October 1st to become vice-president and superintendent of the Wright Tanning Company. Upon the occasion of his retirement from the gas company he was given a surprise party by a large number of his fellow-employees and their families, who went to his home and witnessed the presentation to him of a beautiful gold watch and chain, a gift from one hundred and fifty of his associates in the gas company. The watch was significantly engraved as a tribute from the men.

From an actual photograph taken on the present site of Nevada City in 1852, the year the tens of thousands of red-shirted miners thus crudely gleaned $81,294,700 in gold from California placers

Where the power-lines are run to the changing locations of one of the gold dredgers on Butte Creek, in Butte County, California. Trees have been trimmed to serve as a temporary pole-line on the mining company's property

PACIFIC GAS AND ELECTRIC COMPANY

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Fresno........E. W. Florence
Grass Valley........John Werry
Martinez........Joseph Mayo
Marysville........J. E. Poingdestre
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Nevada City........John Werry
Newman........W. A. Widenmann
Oakland........F. A. Leach, Jr.
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Placer County (East Auburn)........H. M. Cooper
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Stockton (Stockton)........J. W. Hall

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Electra........W. E. Eskew
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Oakland........William Hughes
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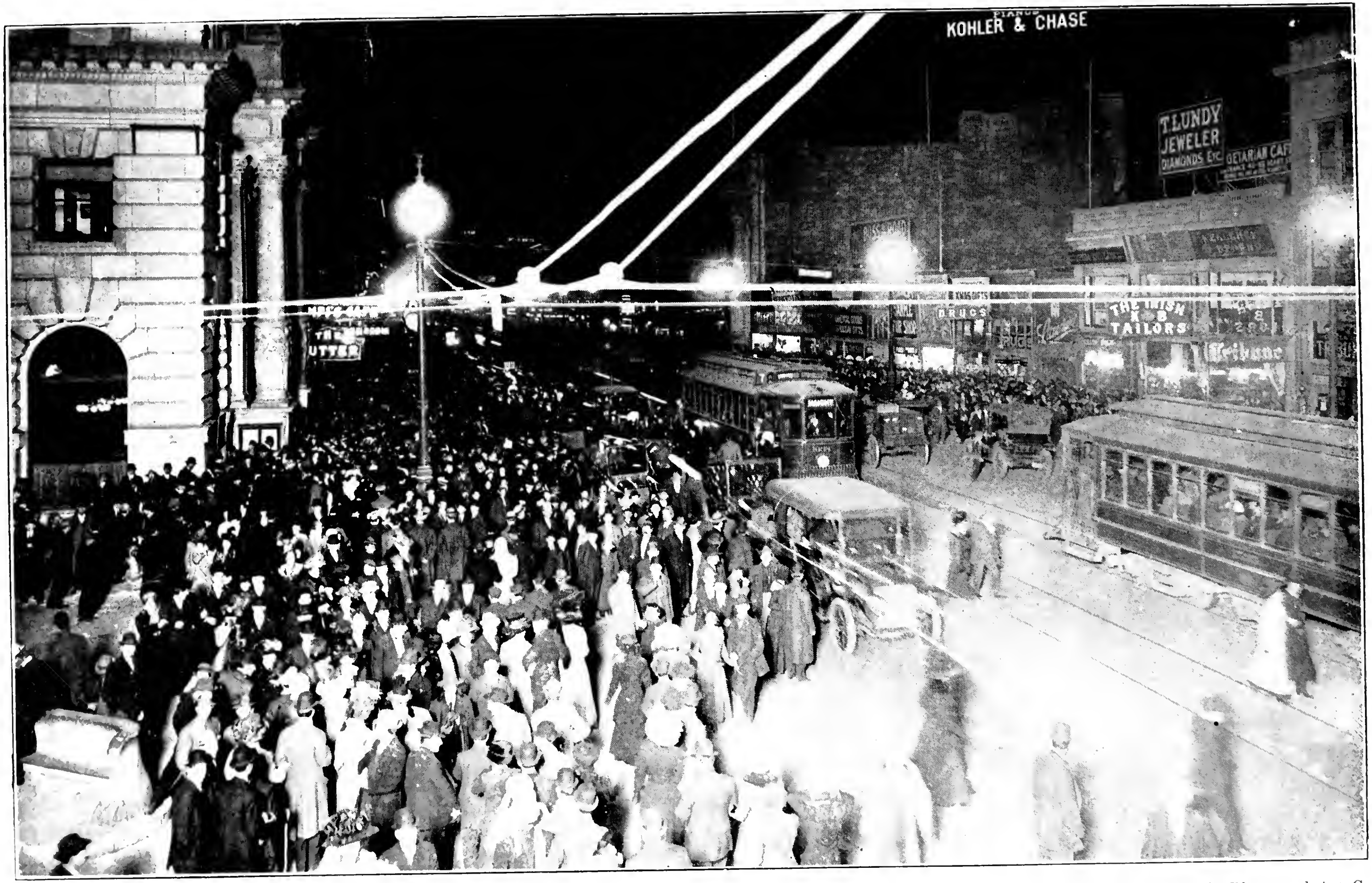

Courtesy of Pacific Photo and Art Co.

NEW YEAR'S EVE—MARKET STREET, SAN FRANCISCO

Courtesy of Pacific Photo and Art Co.

TETRAZZINI NIGHT—CHRISTMAS EVE, MARKET STREET, SAN FRANCISCO

Pacific Gas and Electric Magazine

Vol. II | Contents for December | No. 7

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PACIFIC GAS AND ELECTRIC MAGAZINE

VOL. II DECEMBER, 1910 No. 7

OUR CITY

THIS number of the PACIFIC GAS AND ELECTRIC MAGAZINE is primarily devoted to the interests of San Francisco, "The City loved around the world." The indefatigable energy which has been exhibited by its citizens in the rebuilding from the pile of ashes of 1906, is exemplified by the illustrations on the pages following.

The banks and business houses portrayed stand as monuments of enterprise and as illustrations of the higher types of architecture. While representing only a few of the structures supplied by the San Francisco Gas and Electric Company with both gas and electricity, they are representatives of the type of many thousands of others.

The most sanguine of San Franciscans, having faith in its upbuilding and continued progress, were prepared for the large increase in population shown by the census of 1910; the pessimist, having no faith, would have placed us in another class; the optimist would have us reaching into the next decade; the conservatives are satisfied with the progress shown.

The increase from 342,782 in 1900 to 416,912 in 1910 is evidence that the intrepid spirit of our fair city has risen superior to chaos and cataclysm.

We now rank as twelfth of the great cities of our aggregation of States, and before another ten years, due to the natural influx of population, and the absorption, which must inevitably come, of the surrounding territories, will crowd into at least fourth place.

The achievement in every direction in the development of the City and County of San Francisco augurs well for this increased population.

The city authorities are doing their part, and doing it well, in the establishment of magnificent school buildings, fire houses, and the installation of its high-pressure water system for fire protection, and in improvements recently authorized along the harbor front.

We must get ready for the Panama-Pacific Fair of 1915. We must have more docks for the greater fleet coming to our unsurpassable bay, with greater facilities for loading and unloading cargoes, so that volume of business will warrant a reduction in our toll charges, even if such reduction to compete with other Pacific harbors is paid for by the City and County of San Francisco.

The accomplishment of things that will go to make the greater San Francisco of the future, will come naturally from the spirit of cohesiveness in all affairs mutual to the interest of the city. The recognition and protection of invested capital, whether invested by individuals or by corporations; fairness of legislation, which will promote, rather than discourage, enterprises, and an active, all together, the one for all and all for one policy, which has made our sister city of Los Angeles the prosperous community it now is, which is evidenced by its large increase in population since 1900.

The San Francisco Gas and Electric Company, the pioneer in the introduction of that useful commodity, gas, in the State of California, has had, in its fifty-eight years of existence, an experience entirely dissimilar to that of any other large corporation in the world. Situated as San Francisco is, and was, from the more congested centers of population, and from the territory of its supplies, necessary for the existence of a gas company, it has had to face unequal odds in both the manufacture and distribution of gas, and until the discovery of oil in California in quantities sufficient for large usage, which dates from 1883, was compelled to procure its supplies of coal, necessary for the manufacture of coal gas, from far-away Australia.

With all these handicaps, it remains as the only industry in California that has consistently and constantly reduced the price of gas and electricity, and notwithstanding the increases in costs of labor and material, it has, through its able development of the sciences, been able to supply its commodities at constantly decreasing cost to the consumer; gas at $15.00 per thousand, obtained in 1853, has been reduced to the rate at present prevailing of $1.00 per thousand.

Similarly is this condition true of its service of electric energy. Beginning at a cost to the consumer in 1880 of forty cents per kilowatt hour, it has steadily reduced its price, until today a rate is obtainable, depending upon usage, of from nine cents to three cents per kilowatt.

Its network of gas and electric service is fully shown in the illustrations in this volume. Its gas mains and electric wires, it will be observed, reach every available point in the City and County of San Francisco. Its gas works have a capacity of 16,000,000 cubic feet output in twenty-four hours, and its steam plant for the generation of electricity, a capacity of 35,000 horsepower.

In its gas works it possesses the largest single gas generating apparatus in the world; generators designed by E. C. Jones, Chief Gas Engineer, and having a daily capacity of 4,000,000 cubic feet.

In its electric generating station, in charge of F. H. Varney, Chief Engineer, it has the largest turbo generator installed in the United States, having a capacity normally of 16,000 horsepower, capable of generating 24,000 horsepower.

As an index of the growth of the science of electric generation by steam, it may be stated relatively, that this generator with an overload capacity to 24,000 horsepower, with all of its auxiliaries, occupies a space not exceeding forty feet square. In 1890, with the known development then of the science of electric generation, it would have required a space equivalent to four hundred feet square.

Gas Distribution System

San Francisco Gas and Electric Company

ON the opposite page is an illustration of the gas distributing system of the San Francisco Gas and Electric Company, which, like the electric system, covers all of the present definitely settled portions of the city.

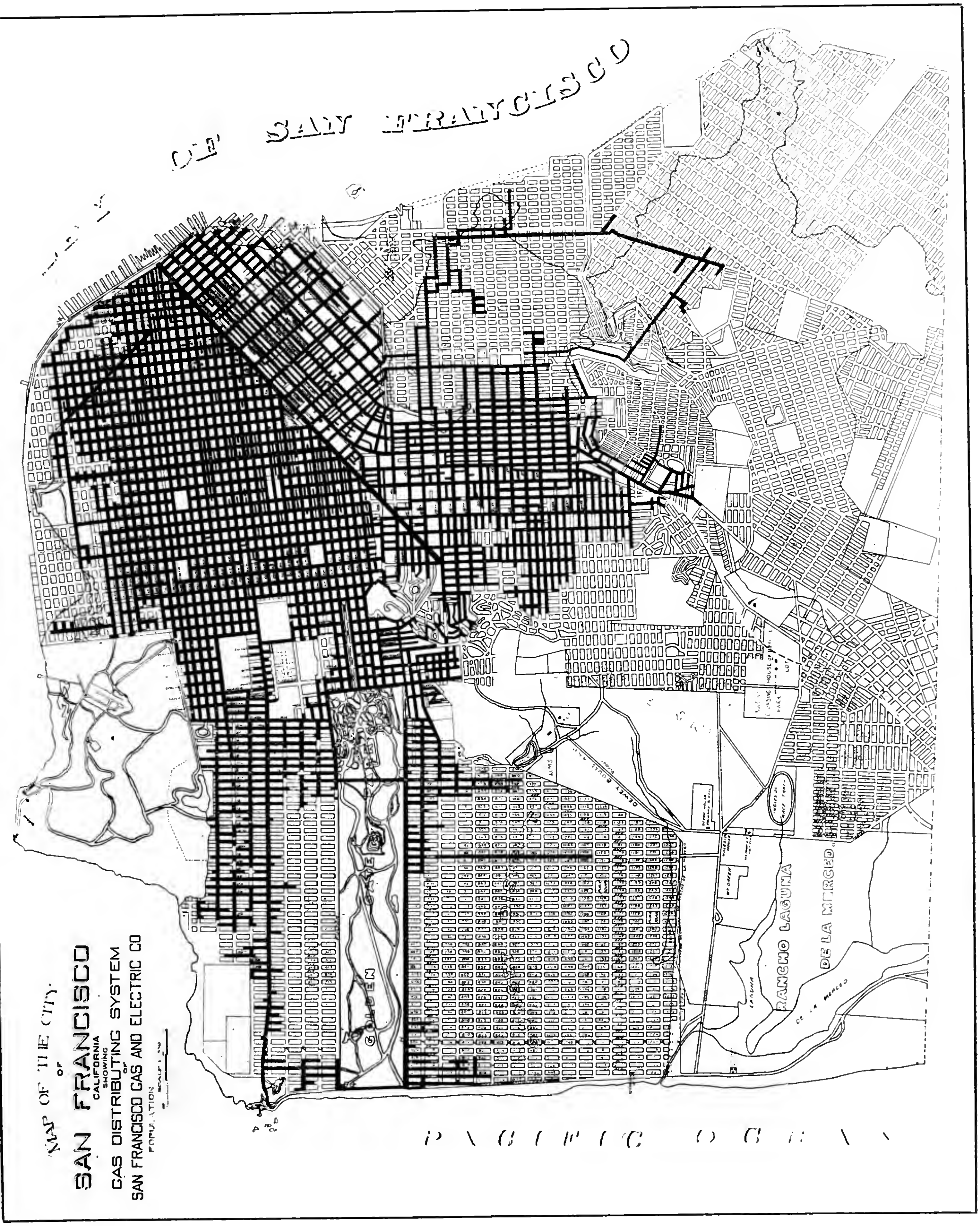
The main generating station is located at the foot of Humboldt street, at the Potrero. From this point, as shown in another illustration in this issue, a 16″ high pressure line conveys gas acrcss the city to the North Beach Station of the company; the 16″ line being tapped at certain points, and by means of governors, supply is fed into the low pressure system. Two gasholders at North Beach also feed into the low pressure system, giving a guarantee of service and regulation of pressure, affording perfect service even to the fartherest limits of supply.

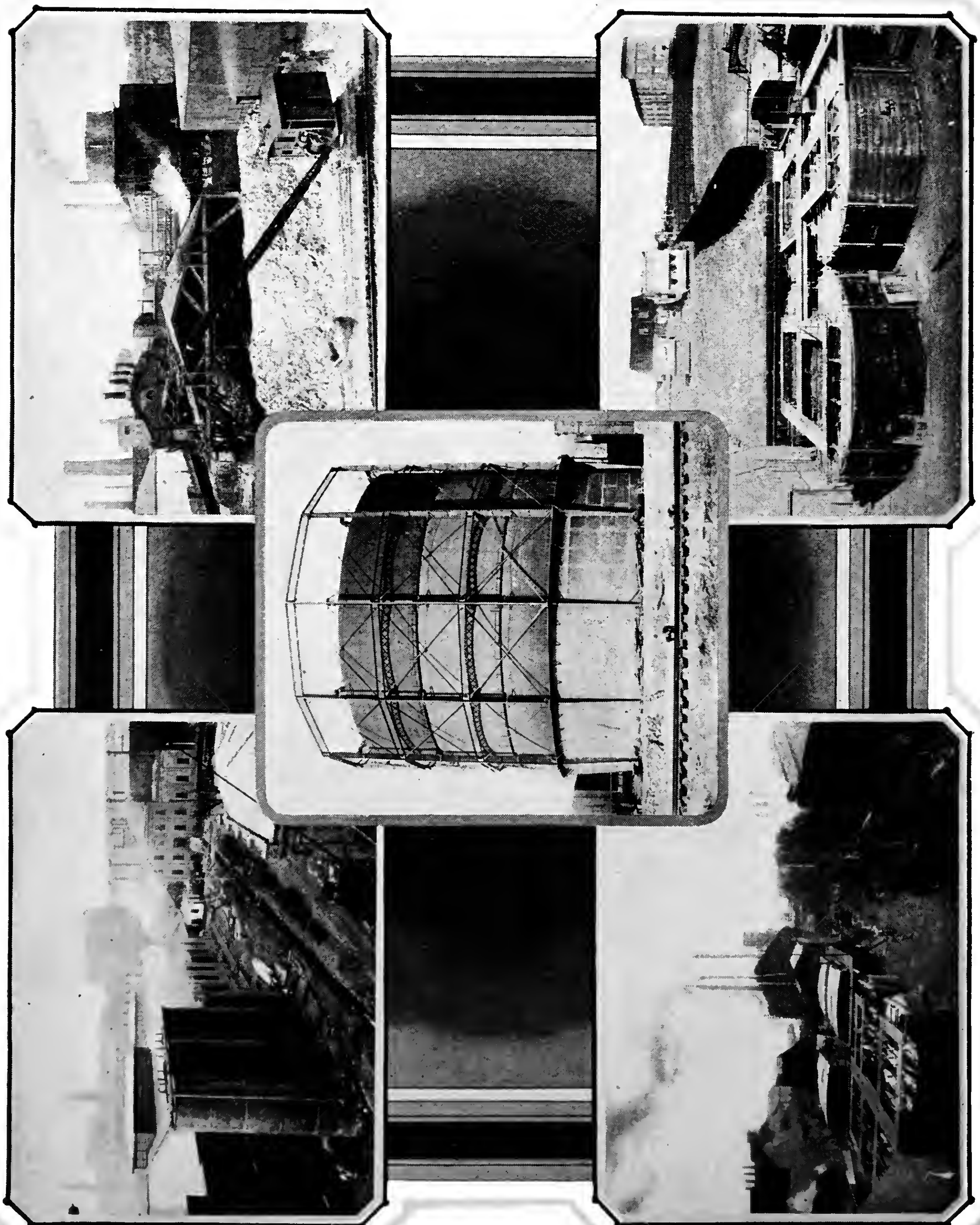
The gas supplied to the people of San Francisco, as determined by regular tests of the City Inspector, average over the 19 candle power required by Ordinance, and materially in excess of the 600 B.T.U.'s., also required by Ordinance. B. T. U.'s. standing for British Thermal Units; that is, each cubic foot of gas contains over 650 British Thermal Units; one Thermal Unit, being the heat required to raise one pound of water one degree Fahrenheit at or near 39.1° F., the temperature of maximum density of water. It will, therefore, be seen that gas delivered for illuminating purposes is ample, while for heating it far exceeds the ordinary requirements of artificial gas, and the demand for this commodity for large heating plants is constantly increasing.

That American manufacturers are successfully reaching out for foreign trade is borne out in the information that the Wilbraham-Green Blower Company of Pottstown, Pa., have just completed the shipment of blowers to Finland, Santo Domingo, British Columbia, Bolivia, Sydney and Cape Breton.

The Gas Machinery Company of Cleveland, Ohio, has been awarded the contract to furnish the new water gas apparatus for the Kirksville, (Mo.) Gas, Heat and Electric Company. The contract also calls for an exhauster, tar extractor, governor, pipe fittings and other necessary adjuncts. The company has constructed the foundation for a holder up to 75,000 cubic feet, and it will further plan a duplicate steam boiler plant.

While this item will not be much in the way of news to the average meter reader, it may nevertheless be surprising to some of those who make the gas—the story is from San Francisco: "Some time ago a representative of the gas company decided that the gas meter of a certain business house was not working properly; in other words, the company was of the opinion that it was furnishing more gas than it was getting paid for, so it decided to examine the meter. Imagine its surprise when it found the meter literally full of cockroaches, which had so interfered with the working of the meter that the gas bill jumped up from about $10.00 to something like $25.00 after the roaches were removed. The business man said that this was the first time he knew that there was any real good in a cockroach."


MAP OF THE CITY
OF
SAN FRANCISCO
CALIFORNIA
SHOWING
GAS DISTRIBUTING SYSTEM
OF
SAN FRANCISCO GAS AND ELECTRIC CO
RANCHO LAGUNA
DE LA MERCED
GOLDEN



The Upper Yard at the Potrero Gas Works

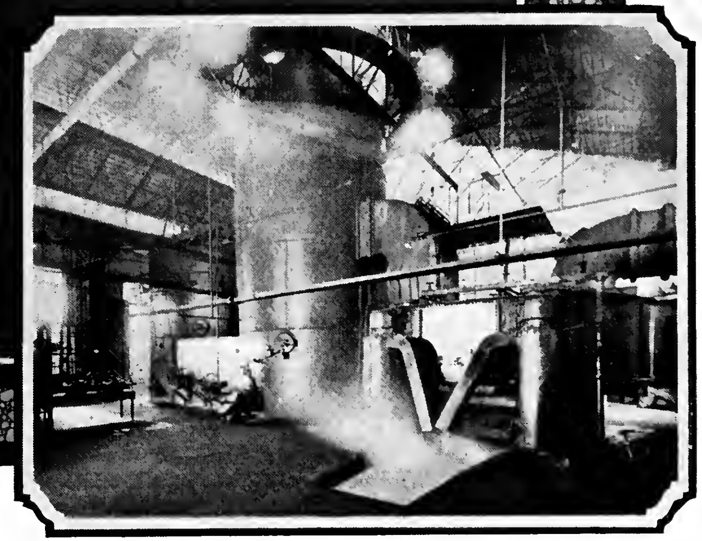
The Lower Yard at the Potrero, showing the Scrubbers and Purifiers

The 1,000,000 cubic foot Storage Holder at the Potrero

"The Coke of Oil"*

Four Wooden Purifiers having a capacity of 1,000,000 cubic feet each twenty-four hours

*This lampblack is the only residual of the oil-gas process, and is immediately used in the manufacture of water gas or for boiler firing.



The Blower Room, which furnishes air for four Oil Gas Generators

The Independent Water Gas Works where lampblack is used in the manufacture of water gas

Site of the new 5,000,000-cubic-foot Gas Holder. Preparing the foundation

One of the large Oil Gas Generators making gas at the rate of 150,000 cubic feet per hour

Electric Distribution System

San Francisco Gas and Electric Company

THE illustration on the opposite page indicates the streets covered by the underground and overhead system of electric distribution of the San Francisco Gas and Electric Company. It will be noted that this service reaches fairly, all of the present populated area needing electric service.

Service is given in the congested centers of population, both by direct and alternating current.

Station A of the company is located in the Potrero, on Georgia street, where current is generated by steam power; cables conveying alternating current to the several substations of the company, located as follows:

Station B, on Townsend Street, between Second and Third streets.

Station C, on Jessie and Stevenson streets, between Third and Fourth.

Station D, on Bush street, between Larkin and Polk streets.

Station E, Mariposa and Vermont streets.

Station G, Ellis and Broderick streets.

Station H, Sunnyvale and Schwerin streets.

Station I, Eighth and Minna streets.

Station J, on Sacramento street, between Leidesdorff and Montgomery.

From stations B, C, D, E, I, and J, direct current is served, and continuity of service guaranteed by the installation of storage batteries, at Stations C, I, and now building at D and J.

The other stations are alternating current, and are for the purpose of reducing high tension current to low tension, for distribution purposes.

No city in the world is better protected by substations and means of supply than is the City and County of San Francisco, as is evidenced by constant service rendered to the consumers of the San Francisco Gas and Electric Company.

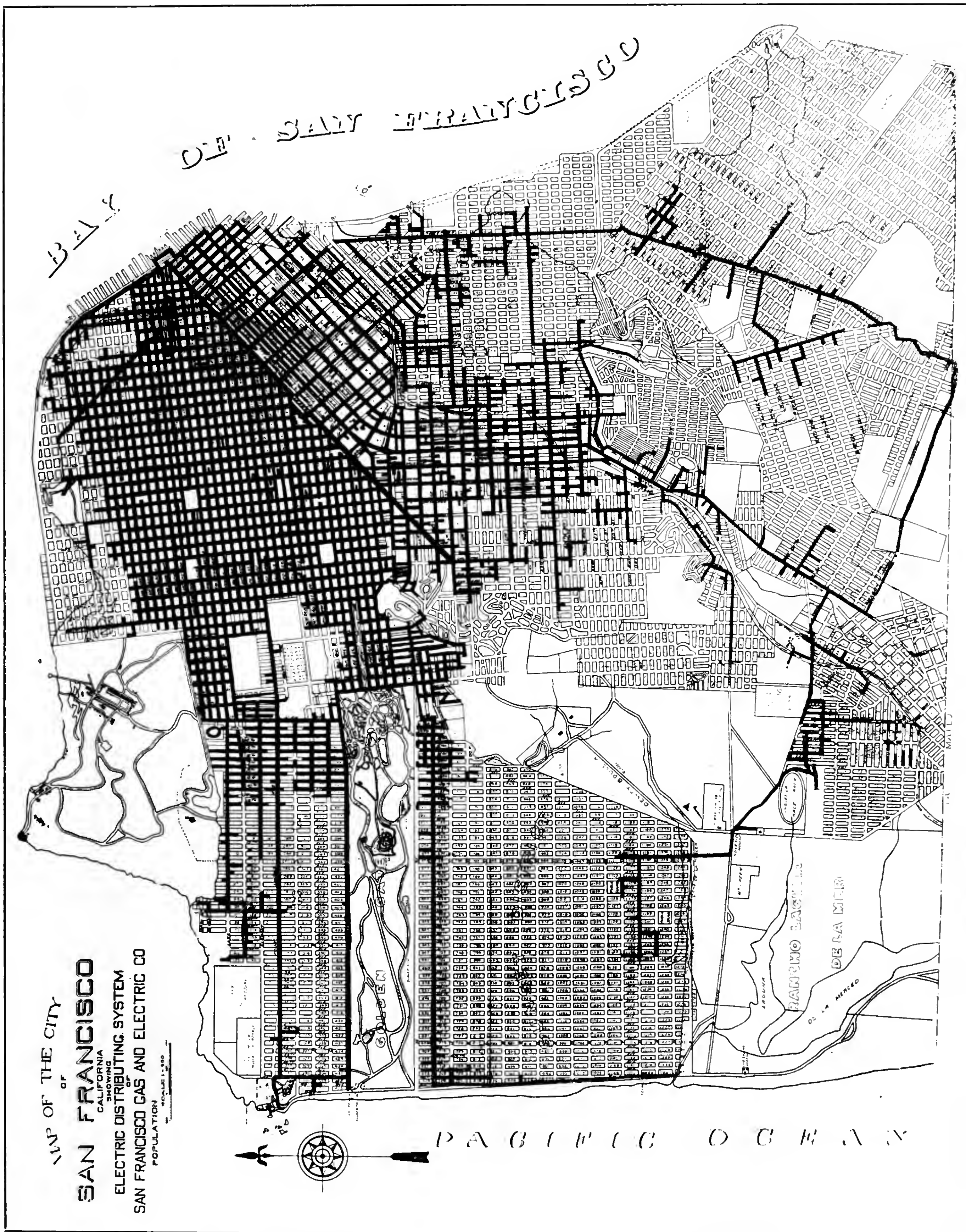
The excellent results obtained from the use of the 7,000-pound electric truck in service in San Francisco has prompted the company to place orders for more electric vehicles. The San Francisco truck demonstrated its ability to climb hills in San Francisco when a reel of cable weighing 6,000 pounds was hauled up a ten per cent grade at a speed of four miles per hour.

In Oakland a Columbus vehicle will be used in delivering lamps. A Detroit one-half-ton wagon will be used in the Gas Service Department, and a 2,000-pound General Vehicle will be used in the Electric Department. Both of these will be equipped with Edison batteries.

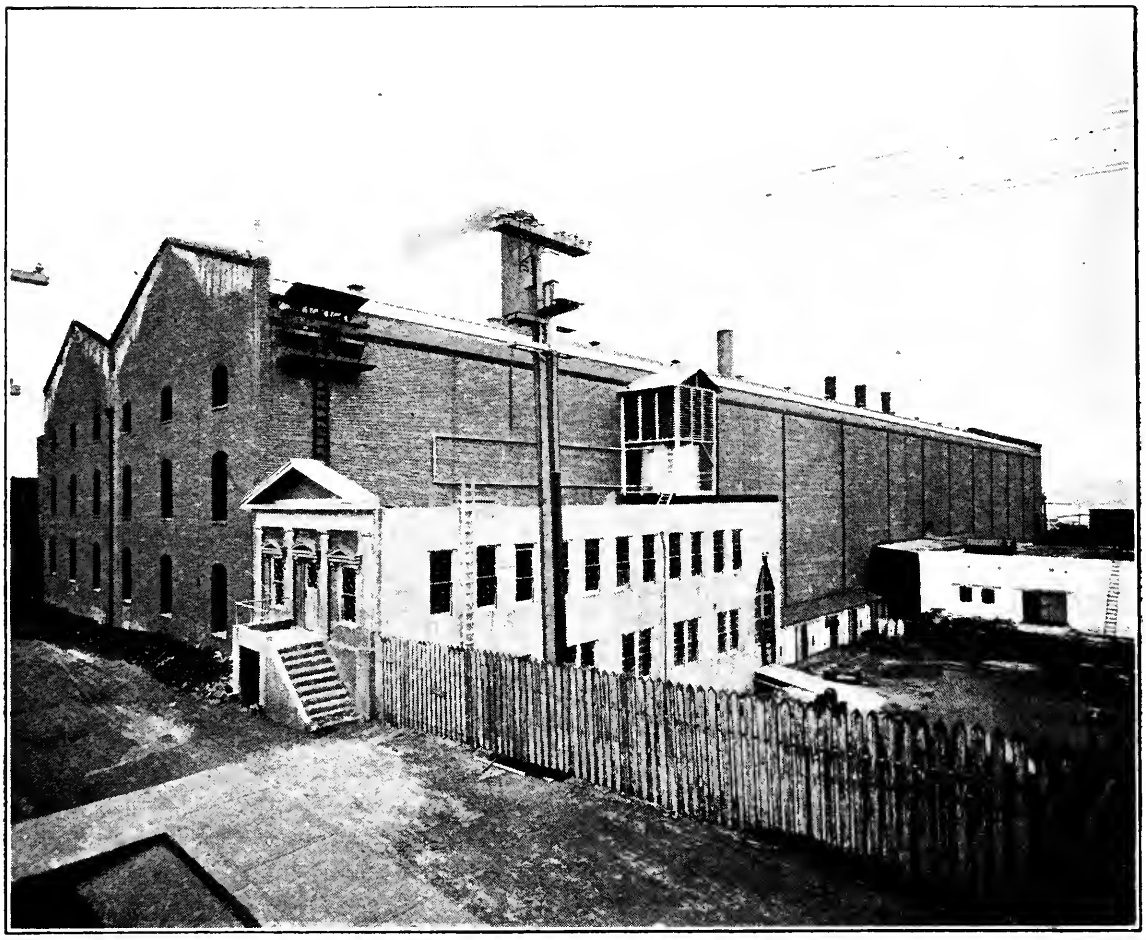
A 1,000-pound wagon will be used in the Gas Department in Fresno. This vehicle also will be equipped with an Edison battery, and can make an average run of 40 miles per day, at a speed of 11 miles per hour.

For Sacramento two electric wagons are on order—one to be used in the Gas Department, and one to be used in the Electric Department. The electric wagon will be of 2,000 pounds capacity. Both vehicles are equipped with Exide batteries.

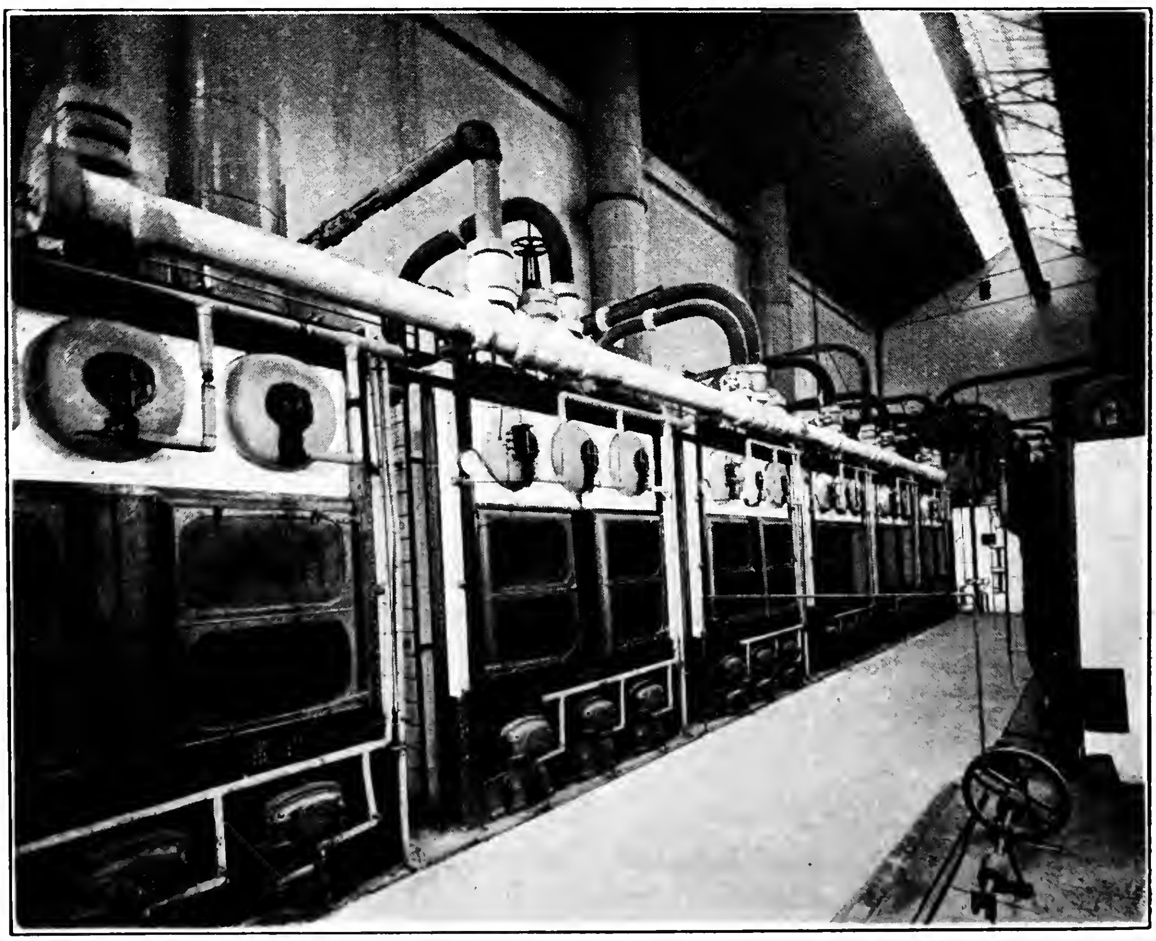
In addition to the above, four Baker Electric Runabouts are already in use in both the Electric Distribution and the Operation and Maintenance Departments in San Francisco.



Total Miles of Streets supplied with Electricity, 227

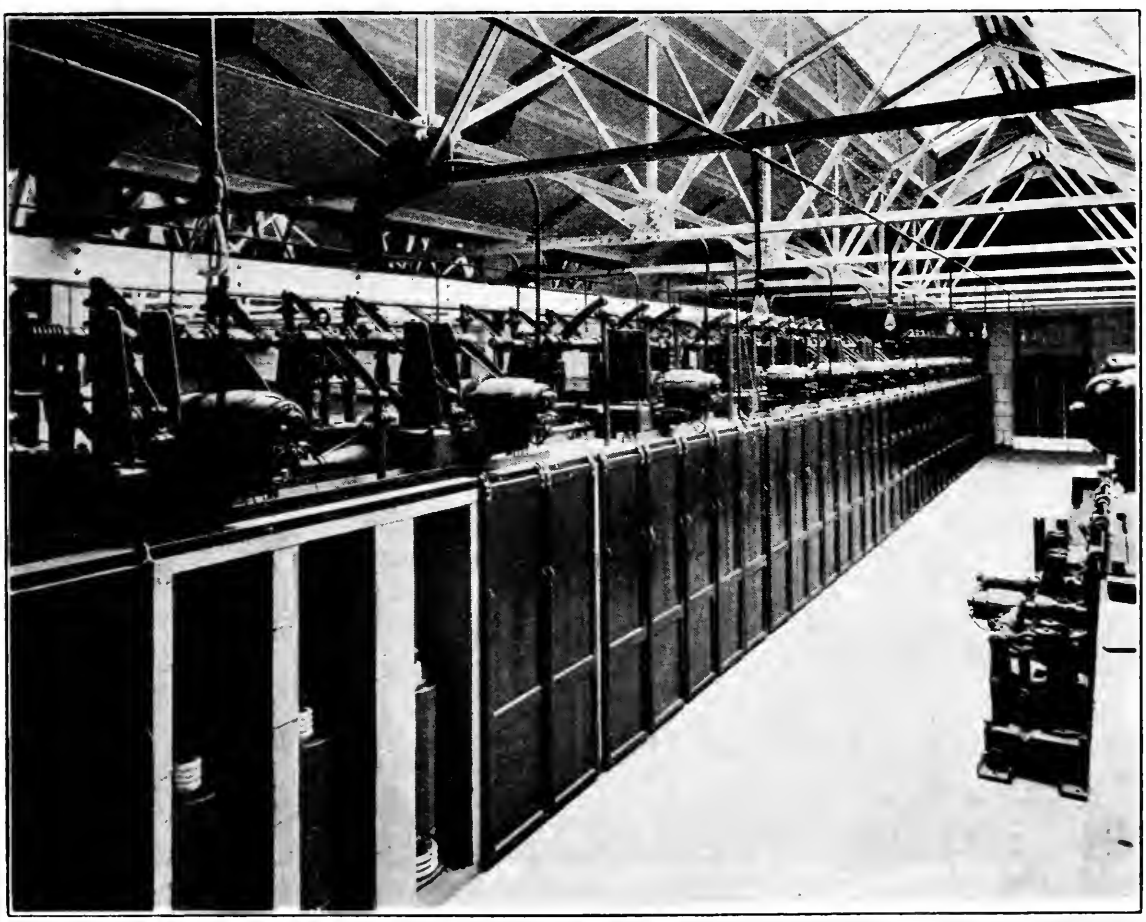


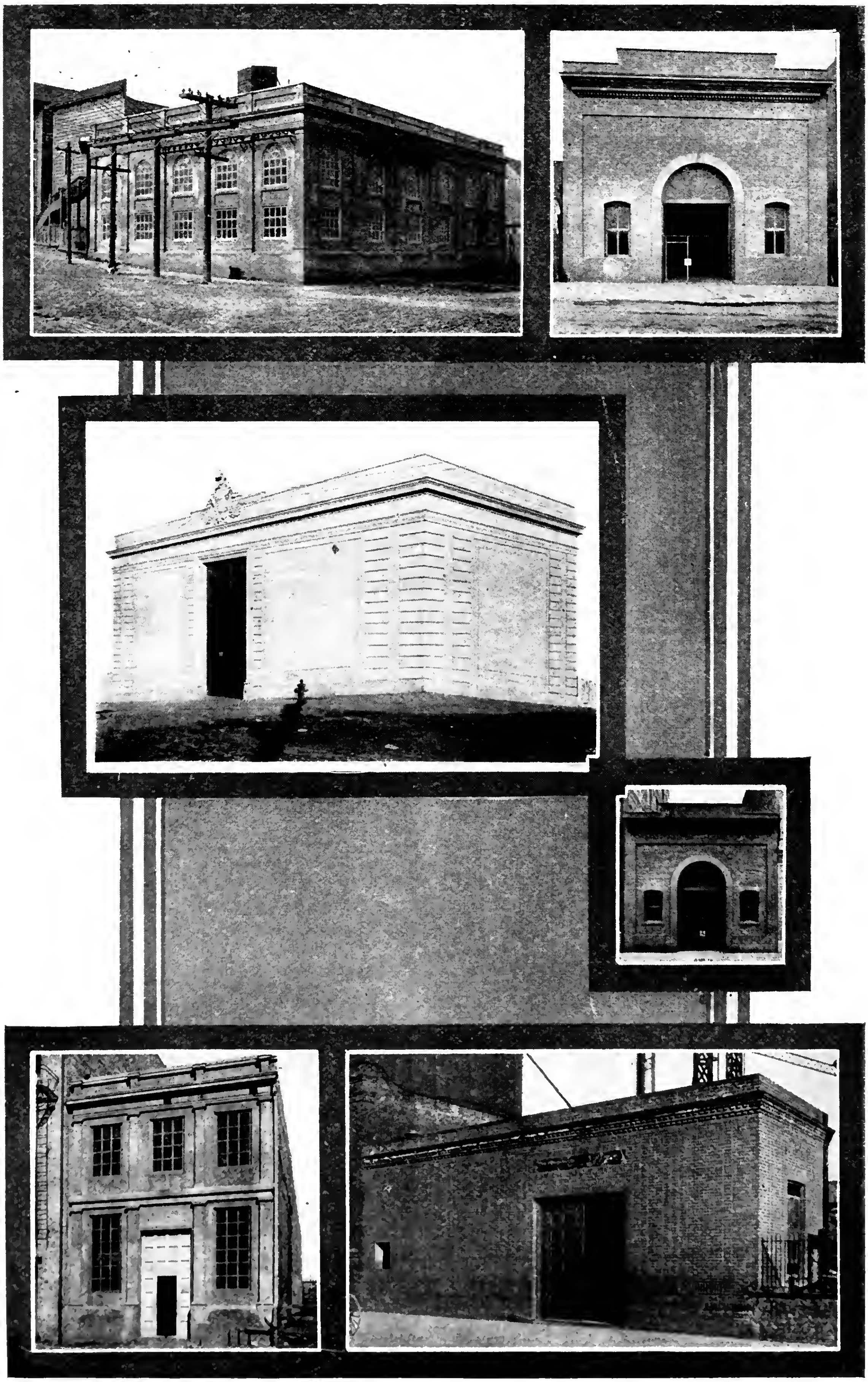
Electric Station "A", Twenty-third and Georgia Streets, San Francisco



Electric Station "A", South Boiler Room

Electric Station "C", Jesse Street, San Francisco


View of the 11,000-volt Oil Switches at Station "C"



Electric Substation E
Elect.ic Substation G
Electric Substation D
Electric Substation I
Electric Substation J
Electric Substation B

Chronological History of Gas and Electric Lighting in San Francisco

By CHARLES L. BARRETT, Secretary San Francisco Gas and Electric Company.

1852, Aug. 31st—San Francisco Gas Company incorporated.

1853, Aug—First cargo of gas coal ordered.

1854, Feb. 11th—Commenced supplying gas. Officers at that date were as follows: Beverley C. Sanders, President and Director; John Crane, Secretary and Director; Giles H. Devoe, Director; James Donahue, Director; J. H. Saunders, Director. While Peter Donahue does not appear as an officer of the company, he was the leading spirit in the organization, the largest stockholder providing the sinews of war.
William Beggs was the engineer.
Location of works, First and Howard Streets.
Coal gas made in iron retorts.
Price of gas, $15 per thousand.
Capital of company, 1,500 shares at $100 par value.

1854, Feb. 14th—Streets of San Francisco first lighted with gas. Lighting district bounded by California on the south, Dupont on the west, Jackson on the north, and the water front on the east. Rate of charge, 32½ cents per lamp per night; present charge, 6½ cents.

1855, Jan.—Total consumers on books, 237.

1855, Nov. 15th—First dividend paid.

1856, Feb. 6th—Price of gas reduced to $12.50 per thousand; April 9th, 1873, price had declined to $4 per thousand; June 30, 1900, to $1.40 per thousand.

1858, Sept. 27th—San Francisco Gas Company donated, gave gas, and laid main for celebration of the successful laying of the Atlantic Submarine Cable between Great Britain and America.

1866—Citizens Gas Company commenced operating. Bought by San Francisco Gas Company, 1868.

1872—City Gas Company and Metropolitan Gas Company commenced operating. Merged with San Francisco Gas Company in 1873, forming San Francisco Gas Light Company.

1874—First exhibition of an electric light in San Francisco by Father Neri at St. Ignatius College, Market Street, between Fourth and Fifth.

1878, Mar. 4th—First legislation inaugurated, giving right to municipalities to fix rates for service of gas.

1879, June 30th—California Electric Light Company incorporated. Capital stock, 50,000 shares of the par value of $100 each. Plant started in rear of what is now Pacific Building, corner of Fourth and Market Streets, soon afterwards being destroyed by fire; second location, south side O'Farrell Street, between Stockton and Powell.
Plant re-erected on Jessie Street, between Third and Fourth, now site of Station C of the company.
Equipment consisting entirely of arc machines, incandescents being at that time unknown. Rate for each lamp being $10 per week; present rate of arc lamps $6 per month.

1882, March—Central Gas Company, predecessor of Central Gas Light Company. Pacific Gas Improvement Company commenced operating.

1883, July 2d—First public electric street light; arc light on pole located on Park Avenue, opposite City Hall.

1887—Sixteen incandescent lamps installed in windows of Rosenthal Shoe Store, Kearny Street, between Post and Sutter; arc current used through two-brush multiple series cutout boxes.

1888—First incandescent lamps used for theatrical purposes in the old Bush Street Theatre for performance of "Little Tycoon."

1889—Station building on Townsend Street, between Second and Third. Early in 1888 incandescent lights first furnished for office building of company, Stevenson Street, between Third and Fourth; for the Cafe Royal and People's Bank in the Flood Building.

1890, Sept.—Additional capacity of incandescents installed, marking beginning of present extensive service.

1890—Equipment of Edison Light & Power Co.'s Stations A and B were as follows:

2 Engines, 375 horsepower each.
1 Savage Engine, 250 horsepower.
1 Ide Engine, 50 horsepower.
1 Arnett & Simms Engine, 50 H.-P.
1 Corliss Engine, 200 horsepower.
1 Savage Engine, 100 horsepower.
6 Thompson-Houston 50-light Arc Machines.
9 No. 8 Brush 60-light Arc Machines.
1 No. 7 30-light Arc Machine.
2 No. 8 Brush 60-light Arc Machines.
2 Brush Incandescent 1000-light Alternate Machines.
1 Todd Engine, 750 horsepower.
1 Allis Engine, 1000 horsepower.
1 Ball Engine, 100 horsepower.
26 No. 8 Brush 60-light Arc Machines.

1891—Tivoli Theatre lighted with incandescents.

1891, July 1st—Edison Light and Power Company formed; George H. Roe, President and General Manager.

1891, Sept.—Gas Works at North Beach commenced operations.

1896, Dec. 11th—San Francisco Gas Light Company merged with Edison Light and Power Company, forming San Francisco Gas and Electric Company.

1898, Feb. 21st—Equitable Gas Light Company incorporated.

1900, Aug. 1st—Independent Electric Light and Power Company's plant commenced operation on present site of Station A, Potrero.

1902—Independent Gas and Power Company commenced operations.

1903—Pacific Gas Improvement Co., Equitable Gas Light Co., Independent Gas and Power Co., Independent Electric Light and Power Co., purchased by San Francisco Gas and Electric Co.

1905—First successful manufacture of gas made from crude oil upon large commercial scale in San Francisco.

1909, Aug.—Office building on Sutter Street completed and occupied, this having been the site of the office building of the Pacific Gas Improvement Company, one of the predecessors of San Francisco Gas and Electric Company.

The illustration following depicts "Larry" Walsh in the act of preparing an Out of Door breakfast on the landed estates of the General Manager of the company. The

smile of satisfaction on his countenance may not be shared by the partakers of the feast, but it is presumed that in the environment of wooded shades, everything, even bugs, go with the breakfast.

"Larry" Walsh highly recommends long rambles in the open country and the consumption of chops, for reducing weight.

RULES AND REGULATIONS
OF THE
SAN FRANCISCO GAS COMPANY.

At a meeting of the Board of Trustees of the SAN FRANCISCO GAS COMPANY, held on the 10th day of December, 1853, the following rules and regulations for the introduction of gas fittings, and the terms upon which the public will be supplied with Gas by the Company, were considered, adopted, and ordered published.

The owners of property will be required to sign a paper of the following purport, before Gas be admitted into their premises, viz:

"I hereby consent that Gas may be introduced into the premises ——————————, of which I am the owner, and in default of payment for Gas consumed in said premises, I also consent that the flow of Gas shall be stopped until the bills be paid."

TERMS, &c.

1. All applications for a supply of Gas must be made at the Company's office in person, or by duly authorized attorneys, the applicant furnishing the consent, in writing, of the owner of the premises, signing the regulations, and stating the probable number of burners that he may require.

2. Gas will be supplied by the meter, and should the meters be found defective, they will be immediately changed. And in case of their ceasing to register the quantity of Gas consumed, the account will be made by the average of another meter, or by the amount charged during a previous corresponding period, at the discretion of the Company.

3. The Company will require security for the payment of the Gas expected to be consumed, or the deposit of a sum in advance, to secure themselves against loss.

4. The service pipe, from the main to the inside of the building to be lighted, will be furnished by the Company, at the cost of the consumer. All meters will be furnished and put up by the Company, without cost to the consumer, except where a shelf is required for the meter, in which case the cost of the shelf will be charged.

5. The Company shall have the authority, whenever it may deem it necessary, to substitute alcohol for water in the meter.

6. The tubings and fittings for the conveyance of Gas within the walls, after it has passed the meter, may be put up by any competent mechanic employed by the consumer, or proprietor of the premises, subject, however, to the inspection and approval of the Company, or its authorized agents.

7. All screws used in putting up Gas tubing shall be made to such standard sizes as may be authorized by the Company, and no tubing shall be used except such as may be now, or hereafter, allowed by them; and all tubing and fittings shall be examined and approved by an inspector, appointed by the Company, previous to being put up, and again examined and approved after being fixed, before Gas will be supplied.

8. The inspector shall at all times be in readiness to examine the apparatus and premises of applicants, free of charge, on receiving three days' notice.

9. The inspector, unless otherwise ordered by the Company, shall introduce the Gas into any premises within the range of the pipes, whenever he shall be satisfied that the fittings are put up in their proper places, in a workmanlike manner, and are perfectly gas tight.

10. The Company, or its authorized agents, shall at all times have the right of free access into the premises lighted with Gas, for the purpose of examining the whole gas apparatus, or for the removal of the meter and service pipe.

11. The tenant of any premises using Gas shall give at least three days' written notice, whenever he is about to remove, that the Gas may be stopped, or he will remain liable for any Gas that may pass through the meter, until such notice is given.

12. The quantity of Gas consumed will in all cases be ascertained in the manner prescribed in the second article of these rules; and the bills be rendered monthly, unless the Company, or its authorized agent, shall think it expedient to provide that they should be settled weekly.

13. In default of payment of Gas consumed within five days after the end of each month, or in case of a leak or injury done to the meter or pipes within the premises of any consumer, the flow of Gas may be stopped, until the bill is paid or the necessary repairs are made.

14. The Company reserves to itself the right to refuse to introduce Gas into any premises until all arrears due in the said premises shall have been paid.

15. The Company reserves to itself the right, at any time, to cut off the communication of the service pipe, if they shall find it necessary to do so in order to protect the works against abuse or fraud.

16. The notice for inspection must be accompanied by a plan of the fittings, drawn to a scale of one inch to eight feet, on which must be marked the size of the tubing and position of the burner; said plans to be numbered by the inspector to correspond with the register of applications, and filed in the office for future inspection.

17. It is advised that consumers be requested to give immediate notice at the office if any escape of Gas be discovered, as no deduction will be made from the bills rendered for Gas passing through the meter, &c.

18. They are also desired to notify the Company as soon in the day as possible, of any deficiency in light, that the evil may be remedied without delay. The Company recommend that proper attention be given to regulating the height of the flame, on which depends the quantity of Gas consumed. By raising the flame to moderate height, the most perfect combustion and brightest light are obtained, and the use of Gas is thus rendered both pleasant and economical, being entirely free from smoke or the least unpleasant smell. The burners should also be kept free from dust; and, if at any time they become obstructed, the application of a brush to the apertures will immediately remove the difficulty.

19. Each consumer of Gas shall, on application at the office of the Company, be furnished with a copy of the foregoing rules.

The office of the Company is at the corner of First and Howard streets, and is open at all times for business purposes.

The price of Gas has been fixed by the Company at FIFTEEN DOLLARS PER ONE THOUSAND CUBIC FEET.

By order of the Board: JOHN CRANE, Secretary.

N. B.—Mr. WM. BEGGS, the Engineer of te Company, IS THE ONLY PERSON authorized to inspect the service and other pipes.

Facsimile Reproduction from Page 74 of San Francisco Directory of 1854

Chamber of Commerce of San Francisco.

CHAMBERS—At MERCHANTS' EXCHANGE, No. 123 Sacramento street.
Organized May 1st, 1850; Incorporated November 3d, 1851.

OFFICERS:

BEVERLY C. SANDERS.............................President.
GEORGE LEWIS COOKE,.............................First Vice President.
GEORGE CLIFFORD.................................Second Vice President.
LEWIS W. SLOAT,.........................Secretary, Treasurer and Librarian.

Committee of Appeals.

D. L. ROSS,
J. J. CHAUVITEAU,
WILLIAM T. COLEMAN,
J. B. THOMAS,
EDWIN HERRICK,
J. FRIEDLANDER.

Places of Amusement.

AMERICAN THEATRE—Sansome street, corner of Halleck. JOHN JONES, Proprietor. Acting Manager, JOHN JONES; Stage Manager, JACOB THOMAN. Open nightly.

METROPOLITAN THEATRE—Montgomery street, between Washington and Jackson. Mrs. CATHARINE N. SINCLAIR, Proprietress. Acting Manageress, Mrs. C. N. SINCLAIR. Stage Manager, J. B. BOOTH, Jr. Open nightly.

OLYMPIC THEATRE—(Formerly Armory Hall)—corner of Sansome and Washington. VINSON, BEATTY & CO., Proprietors. Closed.

ADELPHI THEATRE—(French)—Dupont street, near corner Clay. M. PAUL, Proprietor. Open every Sunday evening.

UNION THEATRE—(French)—Commercial street, above Kearny. Open every Sunday evening.

MEIGGS' MUSICAL HALL—Bush st., near corner of Montgomery. HENRY MEIGGS, Proprietor.

SAN FRANCISCO HALL—Washington street, near corner Montgomery. JOSEPH TRENCH, Proprietor.

GYMNASIUM—Battery street, between California and Pine. FRANK WHEELER, Proprietor. Open day and evening.

Stages and Stage Routes.

UNITED STATES MAIL LINE.—Office, Kearny street, between Clay and Merchant. DILLON, HEDGE & CO., Proprietors. Stages leave this office every morning, at eight o'clock, for the following places, viz: San Mateo, Angelo House, Steinberger's Ranch, Hall's Ranch, Santa Clara, San Jose. *Rates of Fare.*—To San Mateo \$5; Angelo House \$5; Steinberger's Ranch \$5; Hall's Ranch \$8; Santa Clara \$8; San Jose \$8.

UNITED STATES MAIL LINE.—DILLON, HEDGE & CO., Proprietors. Office, Kearny street, between Clay and Merchant sts. Stages leave this office every Sunday, Tuesday and Thursday, for San Juan, Santa Cruz and Monterey. *Rates of Fare*—To San Juan \$15; Santa Cruz \$20; Monterey \$20.

PEOPLE'S LINE—DILLON & CO., Proprietors. Office, Kearny street, between Clay and Merchant. Stages leave this office daily, at 1 o'clock, P. M., for the following places, viz: San Mateo, Angelo House, Steinberger's Ranch, and the Red Woods. *Rates of Fare*—To San Mateo \$5; Angelo House \$5; Steinberger's Ranch \$5; Red Woods \$5.

Omnibus Routes.

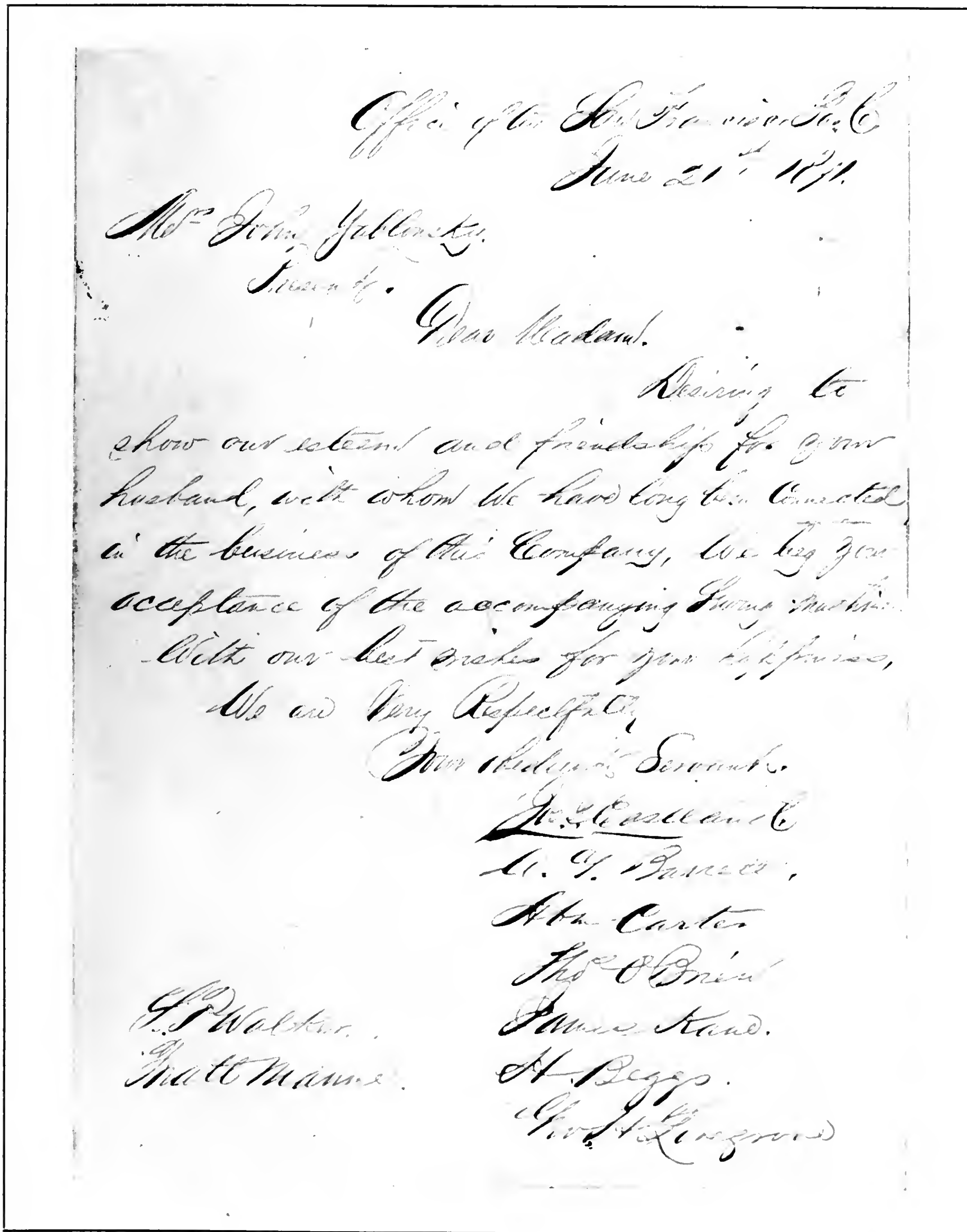
OLD LINE—GRIM & BOWMAN, Proprietors. Leaves the Post-Office Buildings every 30 minutes, from 7 A. M. to 6½ P. M. Through Kearny to Third, down Third to Mission, thence to Mission Dolores. Fare 50 cents on week days, and \$1 on Sunday.

NEW LINE—GRIM & BOWMAN, Propri'trs. Leaves the Post-Office Buildings every half hour, from 7 A. M. to 6½ P. M. Down Clay to Montgomery, through Montgomery to Bush, down Bush to Battery and First, through First to Folsom, thence to Mission Dolores. Fare 50 cents week days, \$1 on Sunday.

Facsimile Reproduction from Page 235 of San Francisco Directory of 1854

WE reproduce herewith letter addressed to Mrs. John Yablonsky, from Joseph G. Eastland, Secretary of the San Francisco Gas and Electric Company. The date of the letter is June 21st, 1871, nearly forty years ago. At that time John Yablonsky had been in the employ of the company over ten years. He has continued ever since in active service, and is today one of the most active of the employees of the company. The present mentioned in the letter was a wedding gift.

There are few men in the world who can show the continued active years of service that have been given to this company by "Johnny", as he is familiarly called.



Office of the San Francisco Gas Co.
June 21st 1871.

Mrs John Yablonsky
Present.

Dear Madam.

Desiring to show our esteem and friendship for your husband, with whom we have long been connected in the business of this Company, we beg your acceptance of the accompanying Sewing machine.

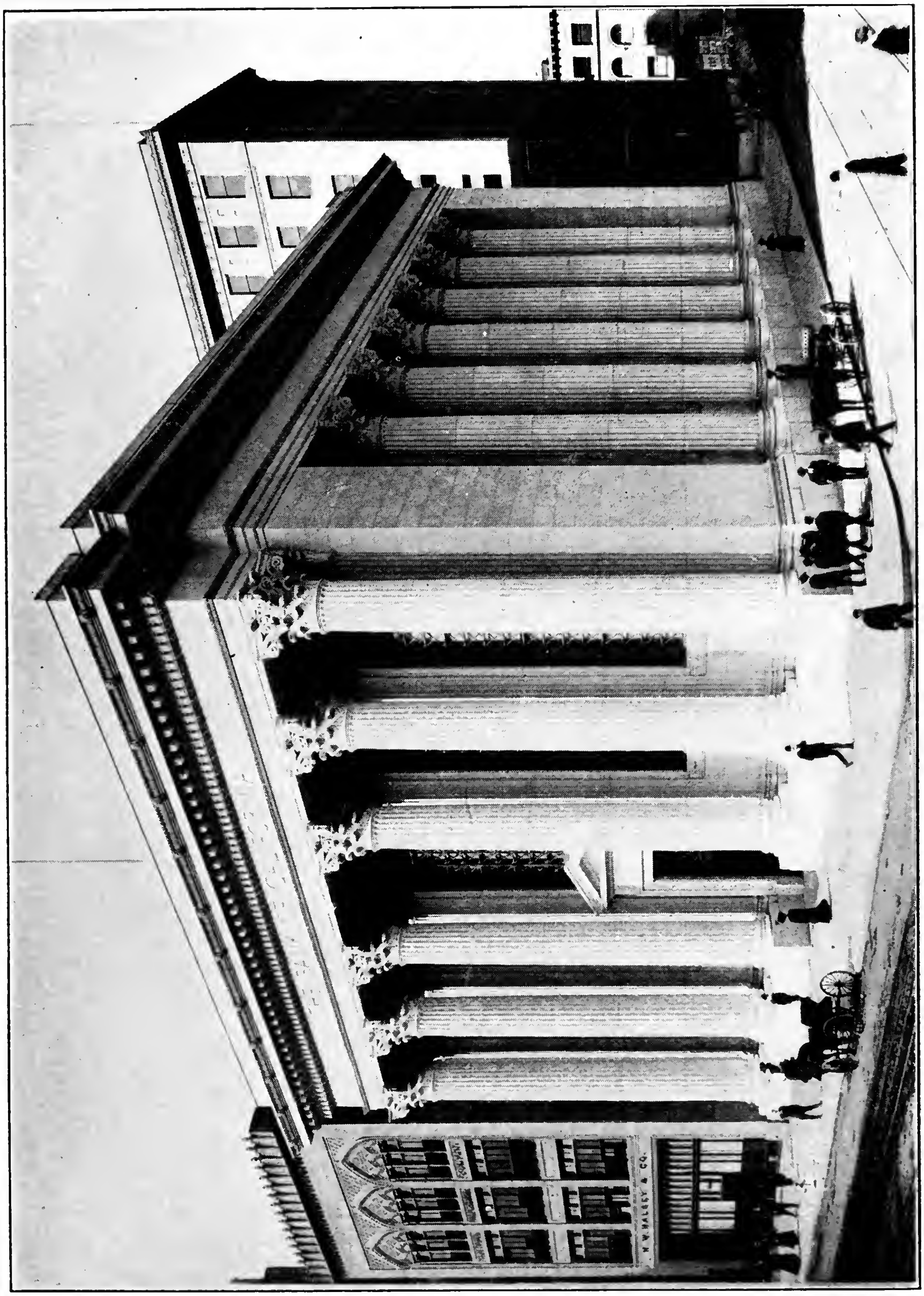
With our best wishes for your happiness,

We are Very Respectfully
Your obedient Servants.

Jos. G. Eastland
A. G. Banner,
Wm Carter
Thos O'Brien
James Kane.
H. Beggs.
Geo H. Hargrove
J. S. Walker.
Matt Maine.

THE BANK OF CALIFORNIA, located on the northwest corner of California and Sansome Streets, represents the highest class of architectural design and fireproof construction. This entire building is used by The Bank of California; the interior is beautifully decorated with marble and fresco work, and illuminated with 700 16-candlepower lamps, and operates a 4-horsepower motor for ventilating fans, etc.

To the left is shown the banking house of N. W. Halsey & Co., 424 California Street.

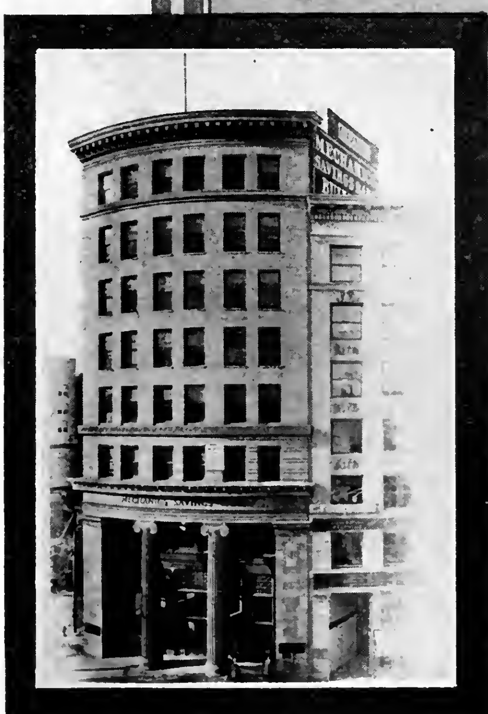


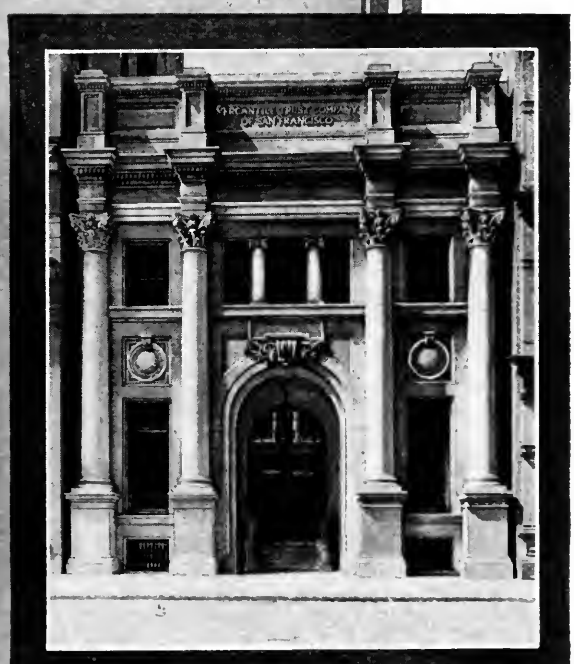
THE UNION TRUST COMPANY of San Francisco, which has just taken possession of its magnificent new individual banking house, O'Farrell Street and Grant Avenue, was formerly for many years located on the corner of Montgomery and Post Streets. This building has an installation of 400 16-candlepower lamps, 10 arc lamps in the dome, and a total of 57½-horsepower in electric motors for elevators, pneumatic tube system, ventilating fans, vacuum cleaners, dumb-waiters, oil pumps and sidewalk hoists.

THE CROCKER NATIONAL BANK occupies the first floor of the Crocker Building at the gore of Market, Montgomery and Post Streets; has been completely reconstructed since the fire of 1906, and combines within its walls the latest innovations in modern banking. This bank is lighted by 380 incandescent lamps; has three motors operating pneumatic tubes, two fan motors, and the different departments are connected by the latest Telautograph system.

THE MARKET-STREET BRANCH OF THE BANK OF ITALY, formerly the Mechanics Savings Bank, in 948 Market Street, corner of Mason, carries on a general savings bank business; is lighted with 800 16-candlepower and 25-watt lamps. The building in which this bank is located has two passenger elevators, with 25-horsepower motor, three pumps using 12-horsepower motor, and one air and oil pump with 2-horsepower motor. This bank is on the main thoroughfare of San Francisco.

THE MERCANTILE TRUST COMPANY is one of the oldest trust companies on the Pacific Coast and occupies its own building in the financial district on California Street. This building was erected just prior to the fire of 1906, received very little damage and has been thoroughly repaired since that time. The building is lighted with 616 25- and 40-watt Mazda lamps. There is a push-button elevator of 1500 pounds lifting capacity, six horsepower, connecting the basement and main floor, in addition to which they have six electric-driven ventilating fans.



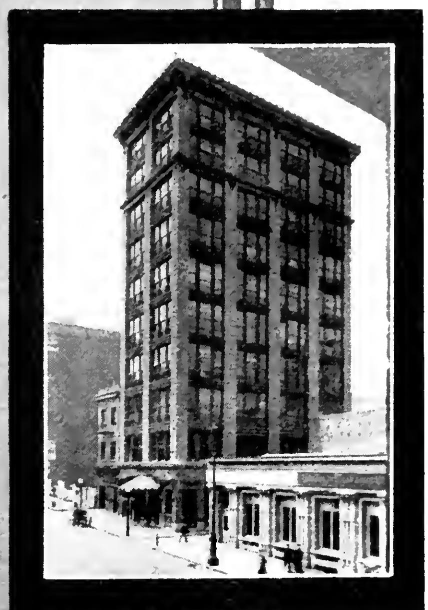


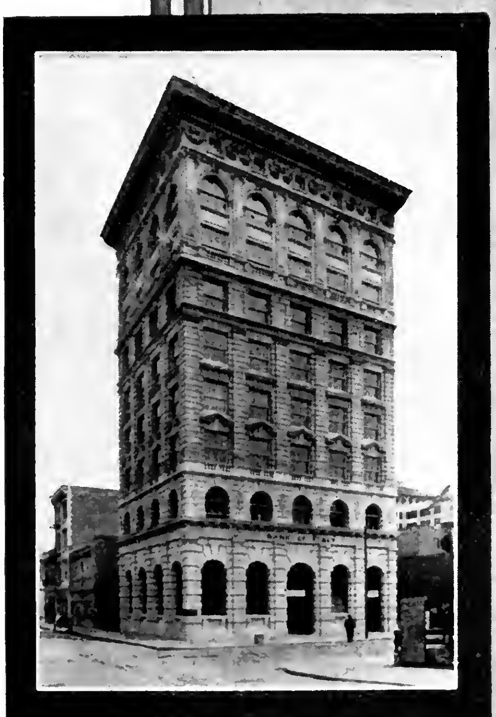
THE BANK OF ITALY in 550 Montgomery Street, carries on a general savings bank business, its clients being drawn principally from the Latin-American people in the North Beach district. This bank and the building in which it is located—a Class A structure—are modern in every detail. The bank is lighted by over 700 lamps, and has a motor installation of 38 horsepower, which cares for elevators, vacuum cleaners, ventilating fans, pumps, etc.

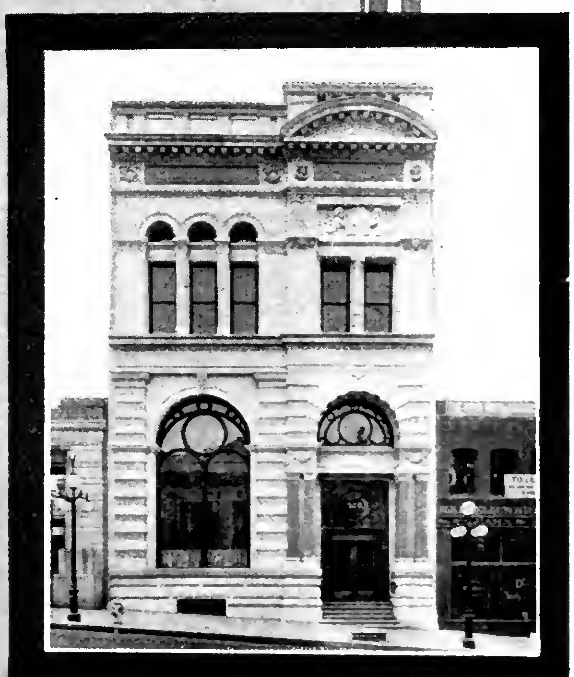
THE FRENCH SAVINGS BANK in 108 Sutter Street, is located in the French Savings Bank Building, which is a Class A structure, erected prior to 1906. This bank is modern in every detail; is lighted with 600 16-candlepower lamps; operates a passenger elevator with 25-horsepower motor, freight elevator with 15-horsepower motor, and operates all pumps and other machinery by electric current.

THE PORTUGUESE-AMERICAN BANK on the southwest corner of Clay and Front Streets, is located in the midst of the commission and produce markets of the city, and does a large commercial and savings bank business. The bank is lighted by 200 16-candlepower lamps, and operates a passenger and sidewalk elevator with electric motors.

THE GERMAN SAVINGS UNION AND LOAN SOCIETY in 526 California Street, occupies its own bank building, which building has been recently reconstructed and arranged to better meet the requirements of this large and growing institution. The bank is lighted with 425 incandescent lamps, and has a motor capacity of 12 horsepower to care for one automatic elevator, vacuum cleaner and ventilating systems.





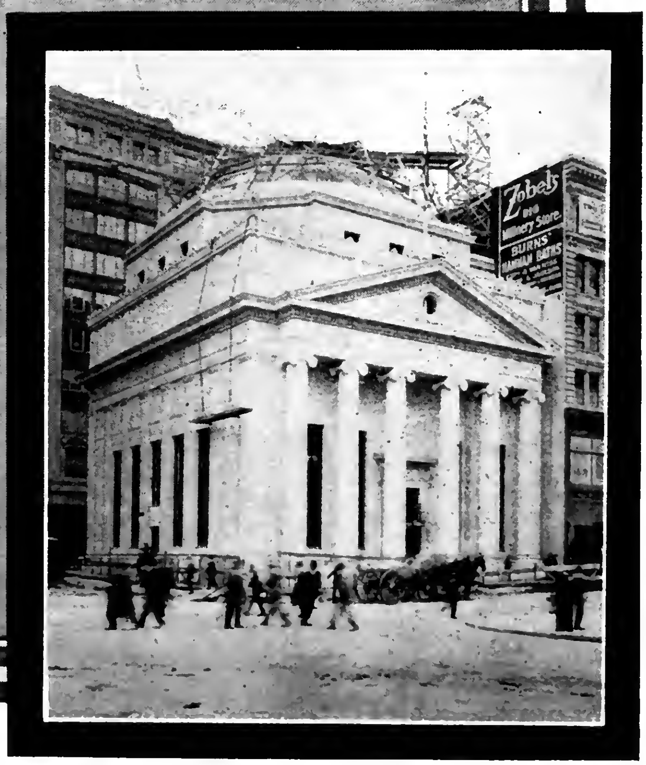


THE HIBERNIA SAVINGS AND LOAN SOCIETY is one of the oldest banking institutions in the world and occupies its own banking building on the northwest corner of McAllister and Jones Streets. The building is of granite, and the interior has recently been renovated and redecorated with an artistic taste not exceeded by any bank in the country. The lighting system, which is arranged to blend with the interior decorative scheme, consists of 500 16-candlepower lamps, in addition to which the building is equipped with elevator, vacuum cleaning and ventilating fan motors.

THE YOKOHAMA SPECIE BANK on Sansome and Sacramento Streets, is an individual banking building and extremely unique in its architectural construction. This bank building is lighted with 150 16-candlepower incandescent lamps and 25-watt Tungsten lamps. Being but one story in height, they do not operate elevators, but are equipped with a 3-horsepower motor which cares for the ventilating system.

THE SAN FRANCISCO SAVINGS UNION is just completing its beautiful individual bank building on the northwest corner of O'Farrell Street and Grant Avenue, and will remove to same probably by the first of the year. This structure is one of the finest banking buildings in the world, and is in a class with the new Bank of California, The Union Trust Company of San Francisco, and several other large banking institutions for which San Francisco is noted.


OFFICE


Zobels
BURNS

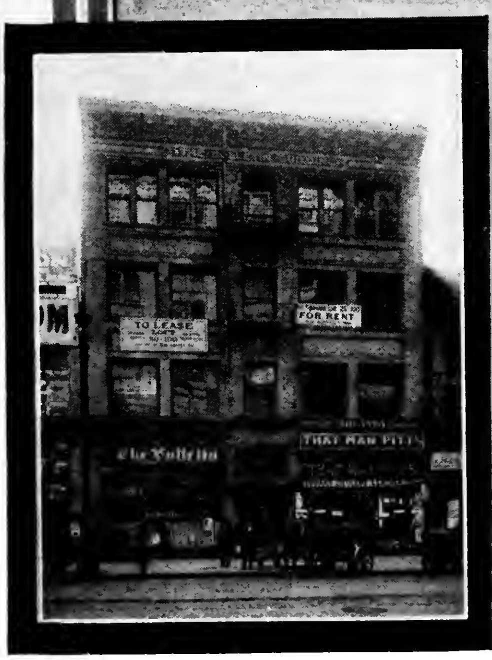
THE PACIFIC BUILDING represents not only a first-class office building, but also exemplifies the ambitious determination of the pioneers and upbuilders of San Francisco, as this building was completed almost immediately after the great conflagration of 1906, and being modern, is equipped similar to the Monadnock Building with every latest device for the convenience of its tenants. The building is lighted with 3,250 lamps, and has a combined horsepower motor installation of 115 horsepower.

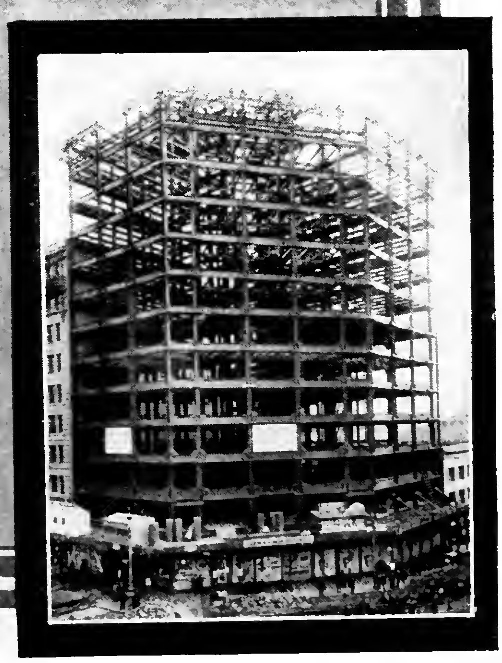
THE MONADNOCK BUILDING, situated in Market Street, east of Third, and the PACIFIC BUILDING, on the southwest corner of Market and Fourth Streets, are representative of the first-class office buildings within the business center of San Francisco. The Monadnock Building is a Class A structure and was erected prior to the fire of 1906. The building is lighted with 3,000 incandescent lamps, and has a total installation of about 200 horsepower for its electric elevators, motors, vacuum cleaning systems, ventilating fans, etc.

THE SAN FRANCISCO CHRONICLE, SAN FRANCISCO EXAMINER, morning dailies, are situated at the junction of Market, Third and Kearny Streets, on what is popularly known as Newspaper Row. The Chronicle occupies its own building, and is one of the finest equipped newspaper offices in the world.

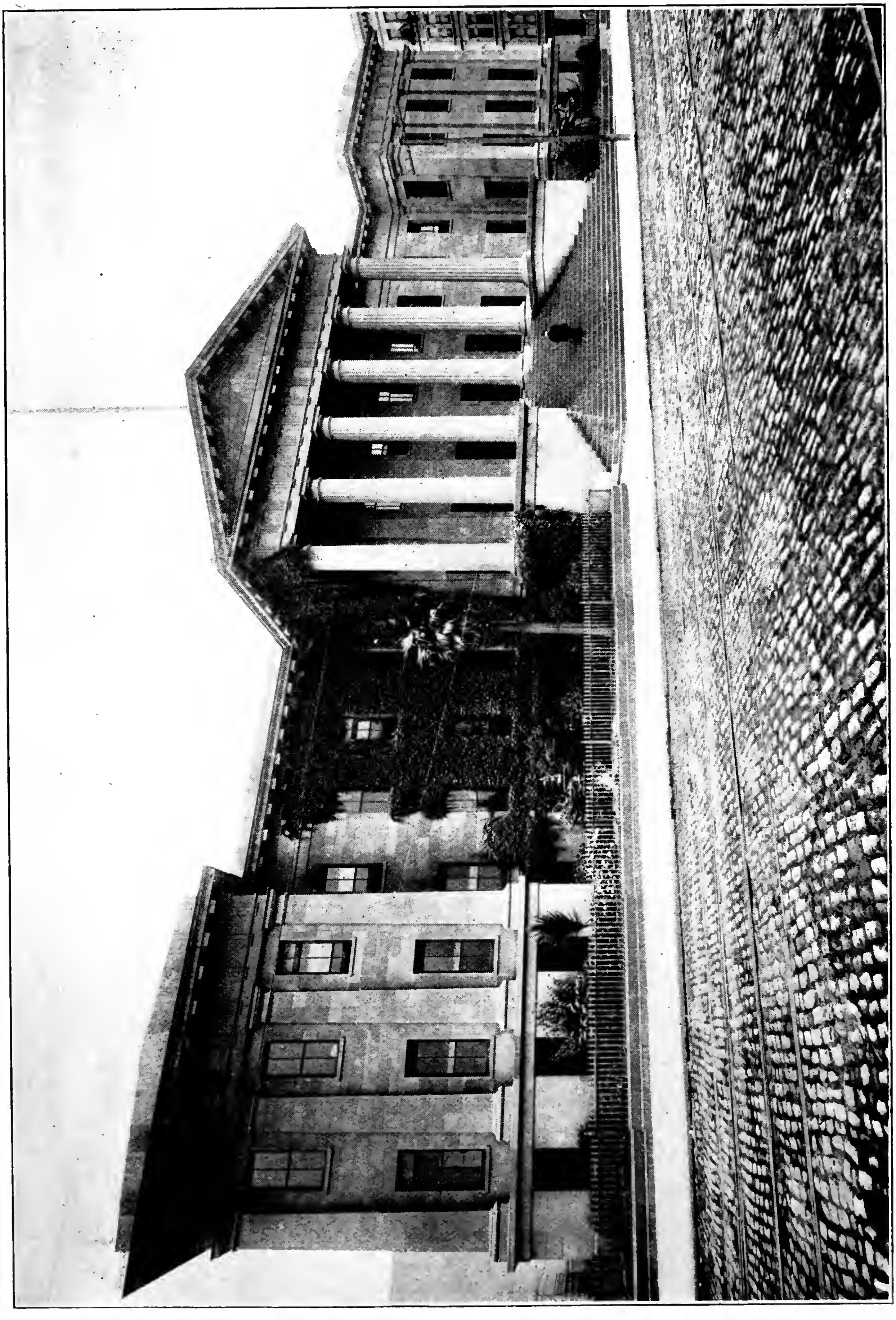
THE SAN FRANCISCO BULLETIN is an evening daily and occupies its own office building in Market Street, between Third and Fourth Streets. This building was one of the first structures completed after the fire and is lighted with 250 lights and has an installed load of 215 horsepower.

THE EXAMINER BUILDING, which is shown in process of construction, when completed will be a Class A structure throughout, and will far excel in architectural beauty, construction, modern equipment, etc., the old Examiner building which stood on the same site. This building when completed, will house the San Francisco Examiner, one of the representative morning dailies, which paper is now occupying temporary quarters.


TO LEASE
FOR RENT



THE SAN FRANCISCO MINT, in Fifth Street, between Mission and Market Streets, is one of the old landmarks of San Francisco, and enjoys the distinction together with the other Federal buildings of having passed through the great fire of 1906 without a blemish. This building is of sandstone construction; is separated from all other properties by streets and alleys, and is one of the principal coinage mints of our Government at the present time. The building is representative of the general style of Corinthian architecture obtaining for Government buildings during the past century, and is one of the landmarks and visiting points for the tourists passing through San Francisco. This building is not only electrically lighted by current supplied by the San Francisco Gas and Electric Company, but is equipped with motors representing a total of 725 horsepower, with 105 motors operating almost every mechanical device used in the minting of coins for not only domestic use, but also for our foreign possessions.



SAN FRANCISCO, located in the central part of California, on the Pacific Ocean, with a uniform temperature the year round, is conceded to be the healthiest city in the world, and, quoting from the remarks of one of our local statesmen, "A man can work more days in the year with perfect comfort, in San Francisco, than at any other point on the face of the earth."

While San Francisco is not a hospital city, for the care of epidemics and contagious diseases, it has within its limits some of the finest operating and surgical hospitals on the American continent. These institutions are privately conducted, have a full corps of physicians and nurses, and cater to not only the city in which they are located, but the entire Pacific slope.

Notable among these institutions is Adler's Sanitorium, Van Ness Avenue and Broadway; St. Francis Hospital, now being completed, in Bush and Hyde Streets; McNutt Hospital, Bush, near Jones Street; and St. Mary's Hospital, Hayes and Stanyan Streets. All of these buildings are first class in their construction, equipped with all modern appliances, including the latest devices in fire escapes and means of safe exit for patients.

St. Mary's Hospital stands out as one of the handsomest buildings of its class in San Francisco. This building is a masterpiece in its beautiful architectural lines and artistic adornment.

McNutt Hospital

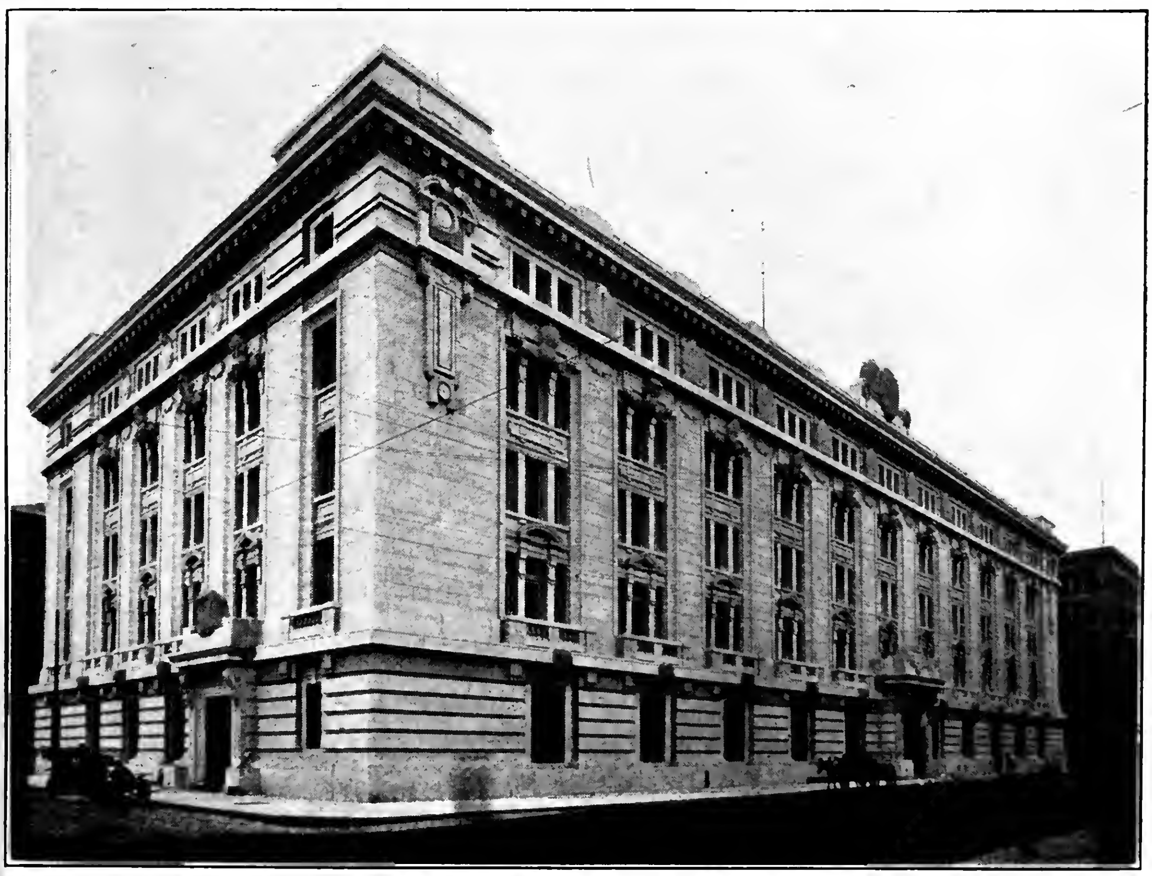
St. Mary's Hospital

Adler's Sanitorium

St. Francis Hospital

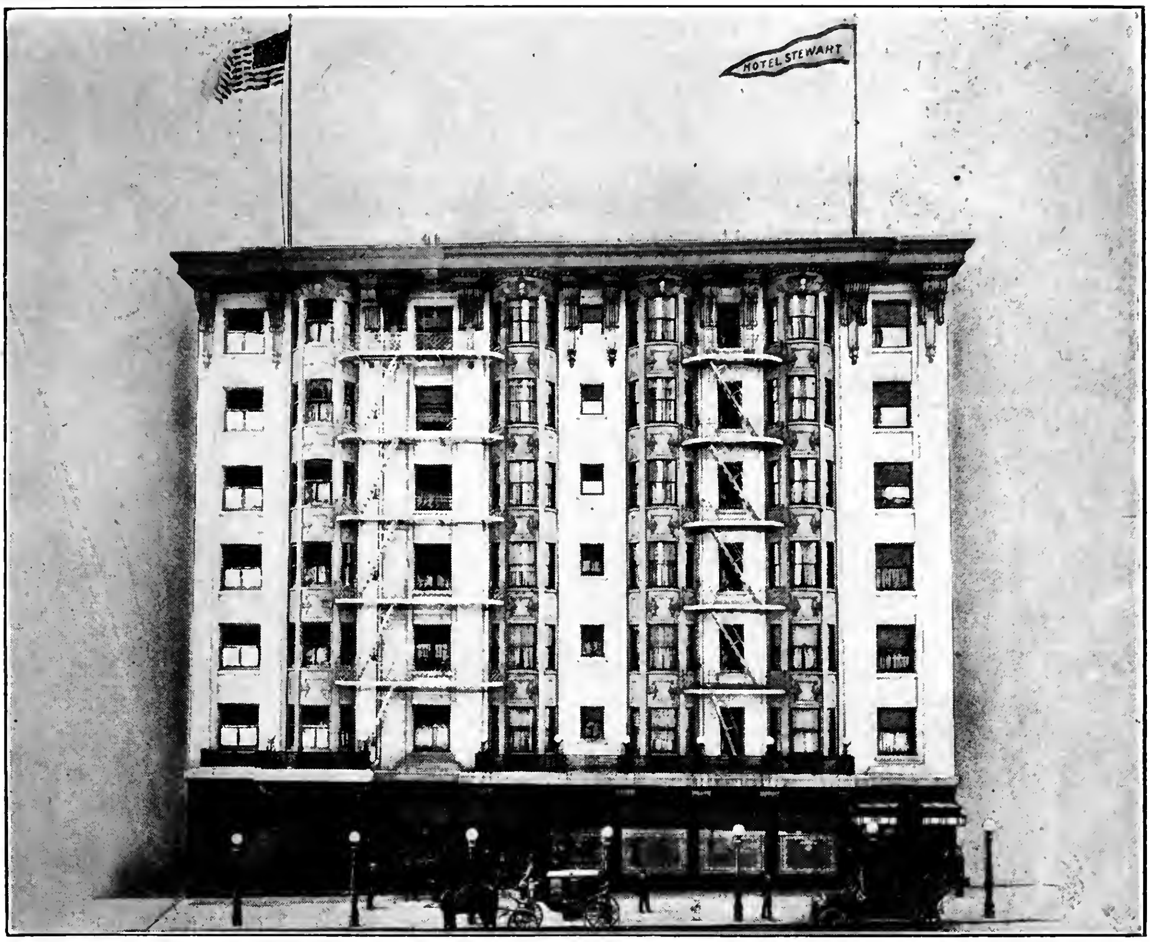
THE APPRAISERS BUILDING, like the San Francisco Mint, passed through the great fire of 1906, being protected by its steel shutters. While this building is old it stands today as a monument to San Francisco, and still serves its purpose of caring for the many branches of the Federal Appraisers Department, in addition to housing the Federal Courts of this District. This building is lighted by electricity, and the elevators and machinery contained in the building, are driven by electric motors.

THE UNITED STATES CUSTOMS HOUSE, which is now nearing completion, is a Federal building constructed on the site of the old Postoffice; is a Class A structure and combines every modern improvement and convenience for carrying on the great customs service of the port of San Francisco. This building is being equipped throughout for electric lighting, electric motors for operation of elevators, and all the essentials of a building of this nature.

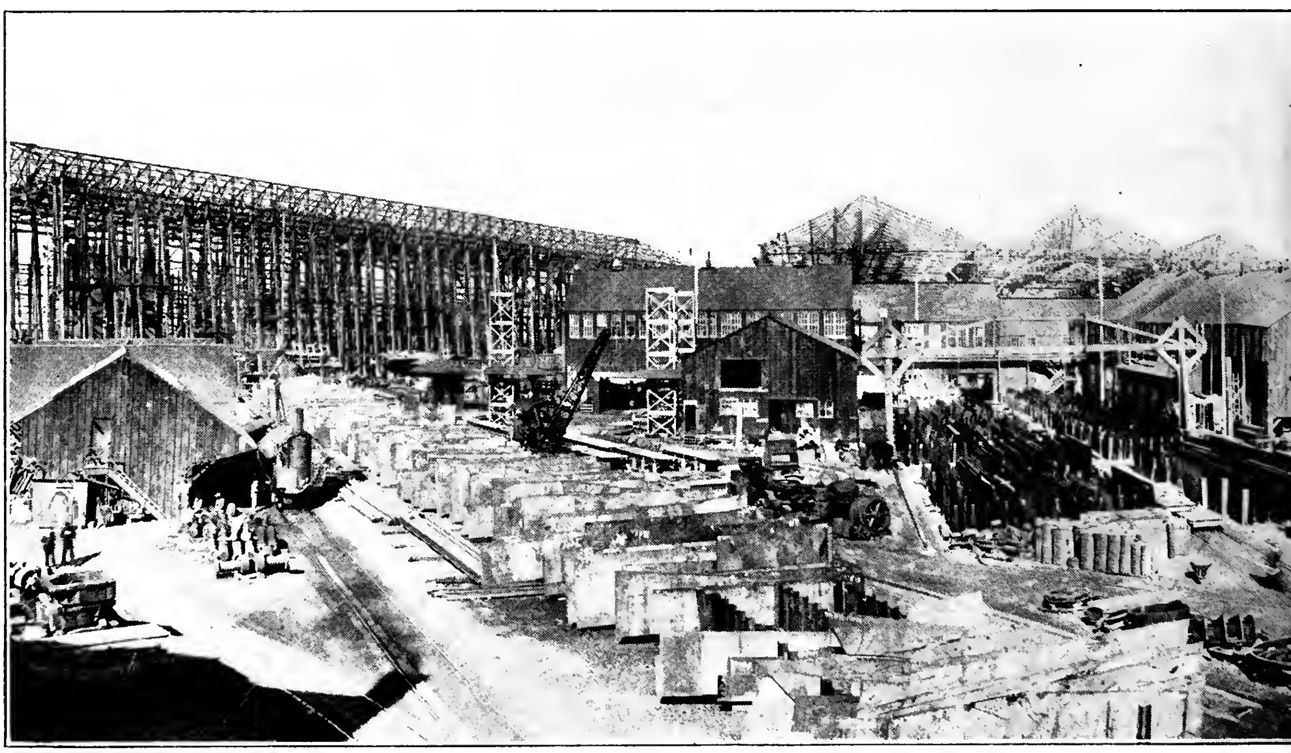


THE HOTEL STEWART in Geary Street west of Powell, is representative of the three hundred odd new hotels erected in San Francisco since the fire of 1906. This building is seven stories in height and has in all 207 guest rooms. This hotel is first class in every respect and is in a class with the Palace, St. Francis and Fairmont Hotels. The building is electrically lighted throughout, having in all about 1,500 incandescent lamps; two passenger and one automatic electric elevators, with a total of 45 horsepower in small electric motors performing the various services necessary to a hotel of this class.

THE ARGONAUT HOTEL, located on the old historic site of the Pioneer Building, Fourth Street and Pioneer Place, and erected since the fire of April, 1906, is one of the largest commercial hotels in the city, and is also the home of the Travelers' Protective Association of the Pacific Coast. This building is credited with 378 rooms, distributed through six stories, is lighted throughout with electricity with 4,000 incandescent lamps; operates three electric elevators and has a combined load in small electric motors of 35-horsepower to perform the various services throughout the building. The building is owned by the Society of California Pioneers.


HOTEL STEWART

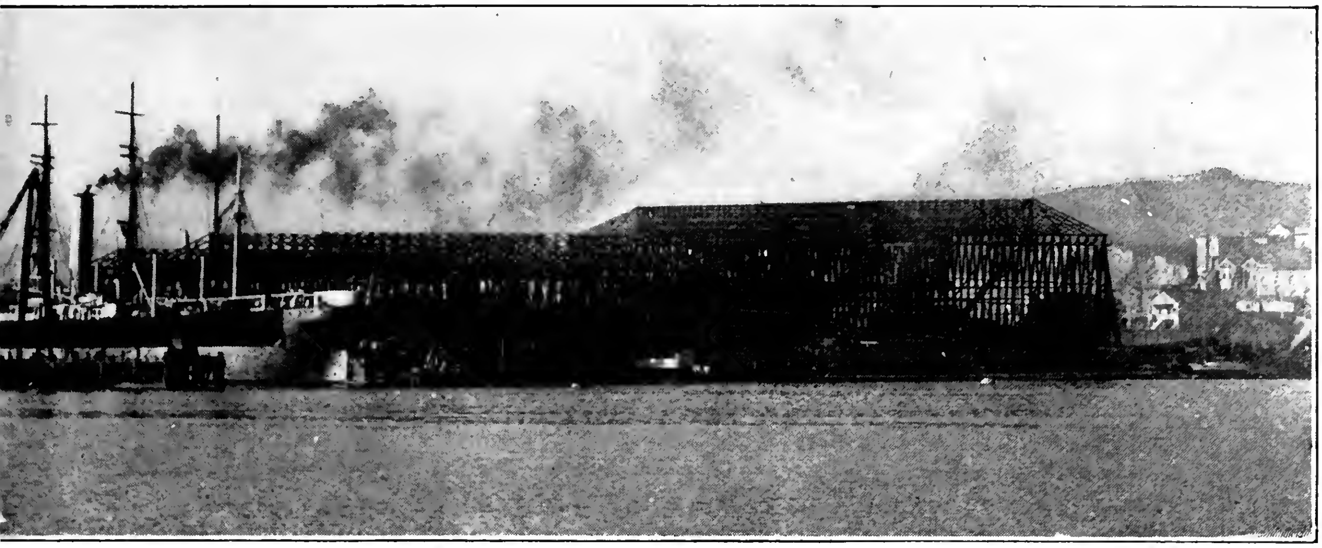

HOTEL ARGONAUT
HOTEL ARGONAUT
(SOCIETY OF CALIFORNIA PIONEERS BUILDING)
SAN FRANCISCO, CAL.

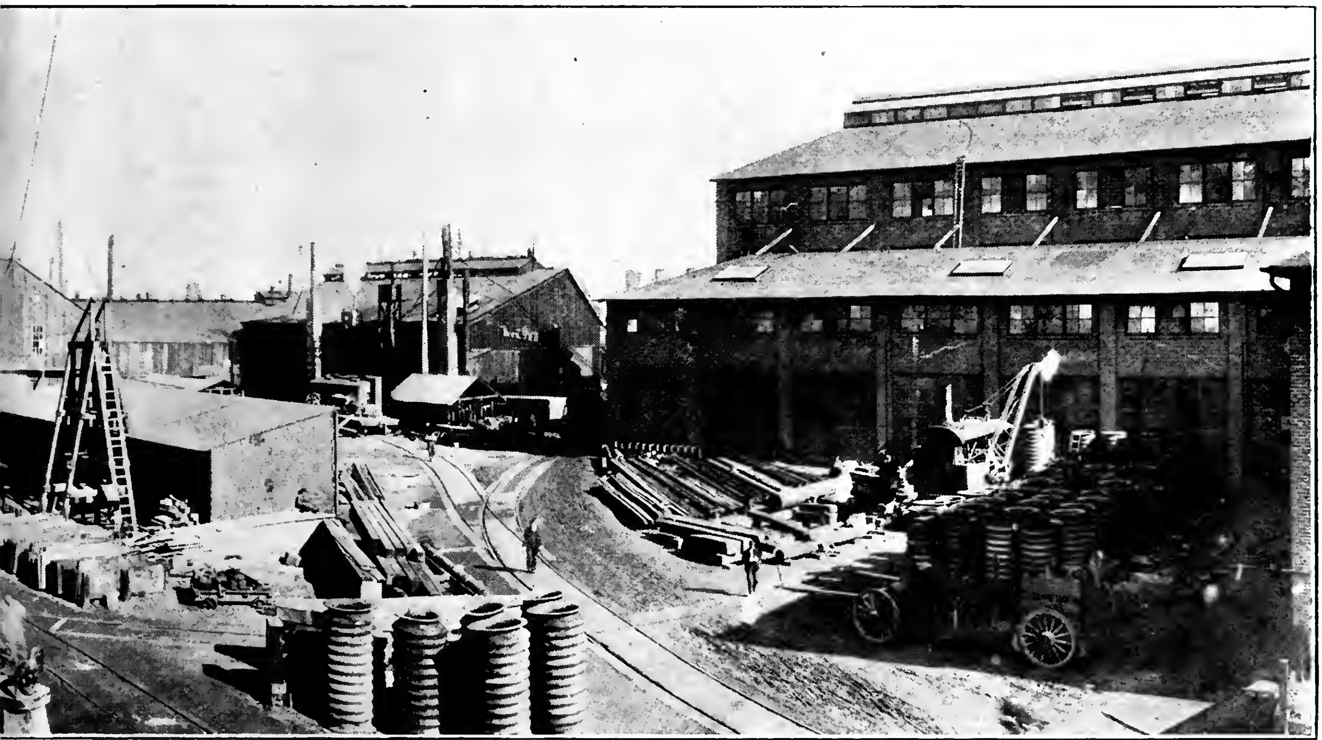


UNION IRON W

THE two cuts above give a general idea of the enormous plant known a
Potrero District. In the first cut is shown the waterfront with vessels
a general view of the buildings, yards, and ship-building plant of this large

The Union Iron Works is being greatly enlarged at the present time by
normal conditions employs about three thousand men, is the largest private
M. Schwab and associates. All the machinery in this establishment is o
by a standard gauge rail line for the expeditious handling of material.
keel to top at this plant, among which were the Oregon, California, and a
Lighthouse services. This concern is also equipped to manufacture the la





ORKS COMPANY

ne UNION IRON WORKS of San Francisco, located on the Bay front in the
ncluding Government warships, docked for repairs. The second cut gives
titution.

dditional buildings and new and up-to-date machinery. This plant under
p-building plant on the Pacific Coast, and is now controlled by Mr. Chas.
ated by electric motors, and the different departments are closely connected
veral of the largest battleships of the United States Navy were built from
a number of lighter-draft vessels in the Customs, Revenue, Survey, and
st types of engines, boilers, and general steam-generating apparatus.

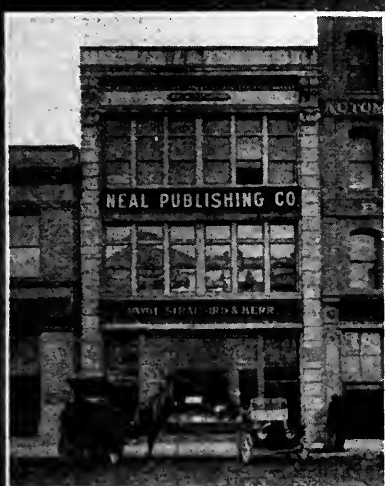
THE SCHMIDT LITHOGRAPHING COMPANY occupy their own building in Second and Bryant Streets and are one of the oldest lithographing companies in the United States, and carry on one of the largest label producing plants in the world. An idea can be gained of this gigantic institution by the fact that they turned out for the season 1910, 600,000,000 labels and cartons. The building is lighted with 497 incandesecent and 10 arc lamps; they have an installed load of 198 motors representing 786-horsepower, their entire plant being operated by electricity.

THE firm of PAYOT, STRATFORD AND KERR, located in Fremont Street, do a general commercial printing and stationery business.

THE CALIFORNIA LITHOGRAPHING CO., INC. This concern is one of the oldest printing and lithographing institutions on the Coast, confining their business principally to commercial and artistic lithographing and engraving.

THE name of BRITTON & REY is linked with the history of California. Its name may be found upon engravings from the very earliest history of our State. It has continued undismayed by any and all conditions ever since. Their place of business is located in 560 Sacramento Street, and utilizes in its work 65 incandescent lights, and 37 1-3 horsepower.


SCHMIDT LITHOGRAPH COMPANY
COMPANY


NEAL PUBLISHING CO.

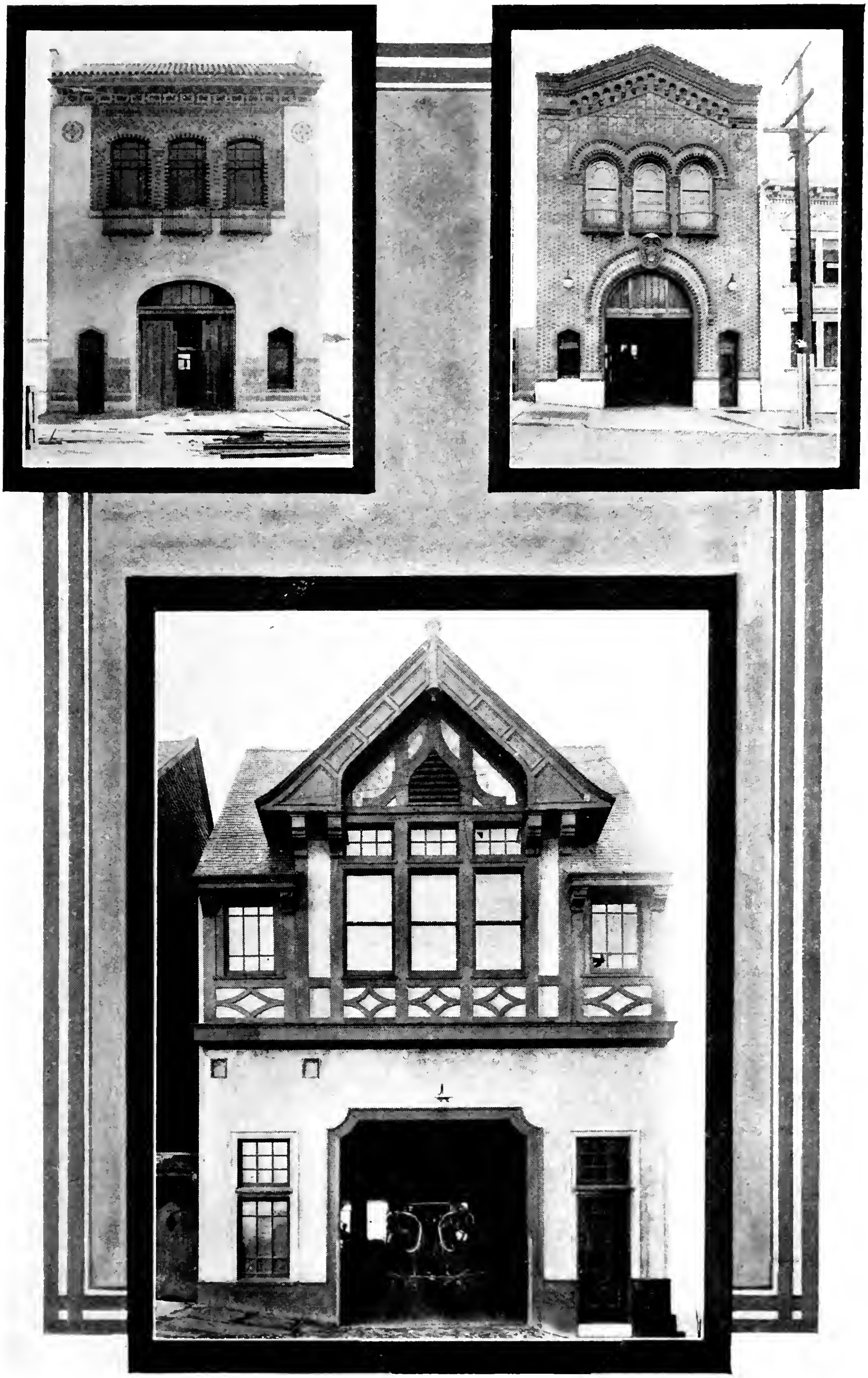

CALIFORNIA LITHOGRAPH CO.
SHANNON-CONMY PRINTING CO


BRITTON & REY LITHOGRAPHERS

THE FERRY BUILDING, at the foot of Market Street, San Francisco, the main gateway into the city, is owned by the State of California and the property and building are under the direct supervision of the State Board of Harbor Commissioners. This building is leased to the different railroads operating ferry lines entering San Francisco, and is also the home of the California Development Board, State Mining Bureau and the State Horticultural Society, in which departments are exhibited at all times the different products of the State, open for inspection by the general public and tourists passing through San Francisco. The tower of the Ferry Building is wired and equipped with permanent sockets to care for 2,000 incandescent lamps for illumination during times of celebration. The nave of the Ferry Building is likewise equipped with 2,000 lamps, in addition to which there are in other parts of the building over 1,600 lamps, and a combined installation of about 40-horsepower in motors operating pumps for the hydraulic bridges and aprons at the Ferry slips, hoisting apparatus, fog bells, and machinery in the blacksmith and repair shops. Plans are now under way for the further enlargement of this building along the water front with added accommodations in the way of slips to care for the ever increasing transbay traffic.

SAN FRANCISCO has always been world famous for the number and high standard of its public schools. Many of these buildings, however, were old from the point of construction and equipment until within the past three or four years, when the Municipal Government took up the matter of reconstruction of most of the school buildings in the city, and we now have some of the finest schools, both from the point of architectural beauty, sanitary construction and modern equipment, in the world. Representative among these are the Mission Grammar School, Frank McCoppin Primary School, Hancock Grammar School, Sheridan Primary School and Commercial High School, shown in this issue of the magazine. The San Francisco Gas and Electric Company, under contract with the city government, supplies all electric current and gas for the lighting and heating of all public buildings within the municipality. These schools are equipped with proper lighting facilities, ventilating fans, pumps, etc., all being driven by electricity.

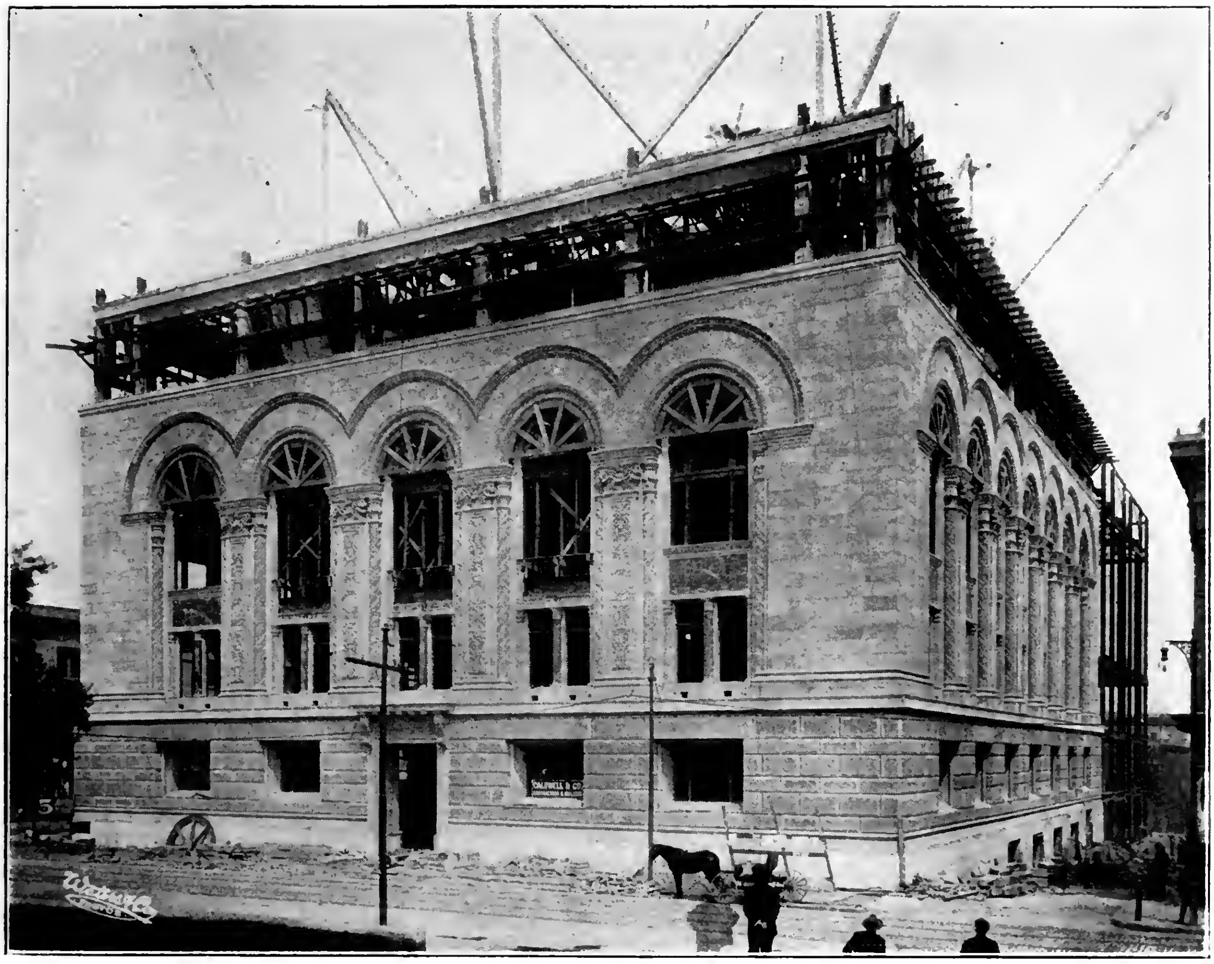
SAN FRANCISCO is world renowned for its Fire Department, which is not surpassed by any city in the United States. Many of the old fire houses have become obsolete and in order to provide better homes for this important branch of the city government, many new and handsome fire houses have been constructed during the past several years, modern in every point and artistic as to exterior design and decoration. These fire houses likewise, are equipped with special lighting features, and with the necessary electrical equipment incidental to the municipal alarm system.



FILLMORE STREET (at night), showing the steel arches illuminated by incandescent and arc lamps, erected and maintained by the Fillmore Street Merchants Association. This street is known as San Francisco's Great White Way.

POWELL STREET (at night), looking south from Post Street towards Market, showing the new hotel and theatre district of San Francisco, with the St. Francis Hotel on the right and Union Square on the left.

THE NEW HALL OF JUSTICE in Montgomery Street, which is nearing completion, opposite the historic Portsmouth Square, will be the new home of the San Francisco Police Department and the Courts of Justice of the municipality. The former Hall of Justice, practically a new building, was destroyed in the fire of 1906. This building is of Class A construction and similar to the other public buildings in San Francisco; will be lighted throughout by electricity, in addition to which numerous motors will be installed to care for elevators, ventilation, etc.



Laying a Sixteen-inch High-pressure Gas Main

By W. R. MORGAN, Superintendent of Gas Distribution.

W. R. Morgan

Years ago within the active brain of the Gas company's chief engineer, an idea was conceived that now is being clothed in tangible steel and concrete. The inspiration is being "turned to shape" in the form of an auxiliary high pressure system that is destined to revolutionize the distribution of gas to the city of San Francisco.

Only those who are familiar with local conditions can comprehend the boldness of this plan to knit together the scattered sagging sections of an unwieldy street main system, and at a single stroke to fuse them into a homogeneous self-supporting structure.

Mr. Jones' plan involves the setting of a train-load of machinery and the building of a five-million-foot gas holder at Potrero Station. It requires an entire re-arrangement of North Beach Station, and the construction of a steel tube 16 inches in diameter and seven miles long, to connect Potrero with North Beach and to supply gas to overloaded sections of the distributing system.

After the fire of 1906 the population centers of San Francisco shifted in a night. Districts which before the fire had been thinly settled, suddenly leaped into prominence as thriving cities. In many cases where formerly four-inch mains had been ample to supply consumers, the demand increased to a point where eight or even twelve-inch mains could hardly carry the load. In Richmond, a district more than two miles from existing trunk lines, the population increased in sixty days from three thousand to more than twenty thousand inhabitants. Only two-inch and four-inch mains were available, and even after the extension of a twelve-inch feeder line, the demand still exceeded the supply. In Sunset, Mission, and other parts

Pipe-yard at Eighth and Brannan Streets

Breaking Ground at Twenty-third and Michigan Streets—The first shovelful

of the city conditions at peak hours were similar, though not quite so bad. While only a skeleton outline, this brief description will serve to give some idea of the breach which the high-pressure main was designed to fill.

Connections to the distributing system were planned through district governors to be located at points from which areas of low-pressure could be reached and the small mains supported by ample pressure and sufficient volume. The first governor is at Army and Shotwell streets, and is arranged to supply the Mission district. Another at Dolores and Market streets will supply the heights southwesterly from this point. From Page and Webster streets the Sunset will be supported, and from Geary and Webster streets, the Richmond mains, still overloaded, will be kept up to normal pressure. The fifth governor is located at North Beach.

Lem B. Jones
Engineer Potrero Station

John Reynolds
Foreman of Prospect Gang

After it was finally decided to lay the main, the first question demanding attention was the route to be followed. To avoid electrolytic action it was deemed wise to select streets free from electric railroads. Underground obstructions, such as electric conduits, other large mains, city water cisterns, had to be considered. After going over the ground very thoroughly the route was chosen as follows:

From Michigan and Twenty-third streets, Potrero, through Twenty-third street to Kentucky to Army to Shotwell to Fifteenth to Dolores to Market to Duboce to Webster to Bay to the 2,000,000-foot holder at Bay and Buchanan streets. The distance is 35,000 feet approximately, and elevations range from 6 feet to 256 feet above city base.

In March, 1910, material was ordered, and as received, was distributed to several convenient points along the route; at Potrero Station were stored 7,000 feet of pipe and 2,400 Dresser couplings, which later were hauled as required. At Army and Vermont streets 5,000 feet of pipe; Sixteenth and Harrison streets 11,000 feet; Eighth and Brannan streets 10,500 feet, and at North Beach Station 3,000 feet.

During the month of June the work of unloading and distributing material and transporting equipment was carried on rapidly. All street crossings were prospected, obstructions plotted and the job carefully laid out.

Actual main laying was started Tuesday, July 5th, 1910, at the Potrero, and within two months the line had been extended to North Beach Station. During the months of September and October five concrete governor pits and six 16-inch valve pits were built, blower and compressor machinery installed at Potrero, and connections rearranged at North Beach. The line was purged of air and put in commission November 21st.

After pipe-laying was started and from day to day as the work progressed, every detail of construction was photographed; these pictures practically form a continuous panoramic view extending from station to station, and will give a clearer and truer idea of the various operations than could be conveyed by the amount of written description.

Army Street between Kentucky and Iowa, and view of the same street taken forty-eight hours later

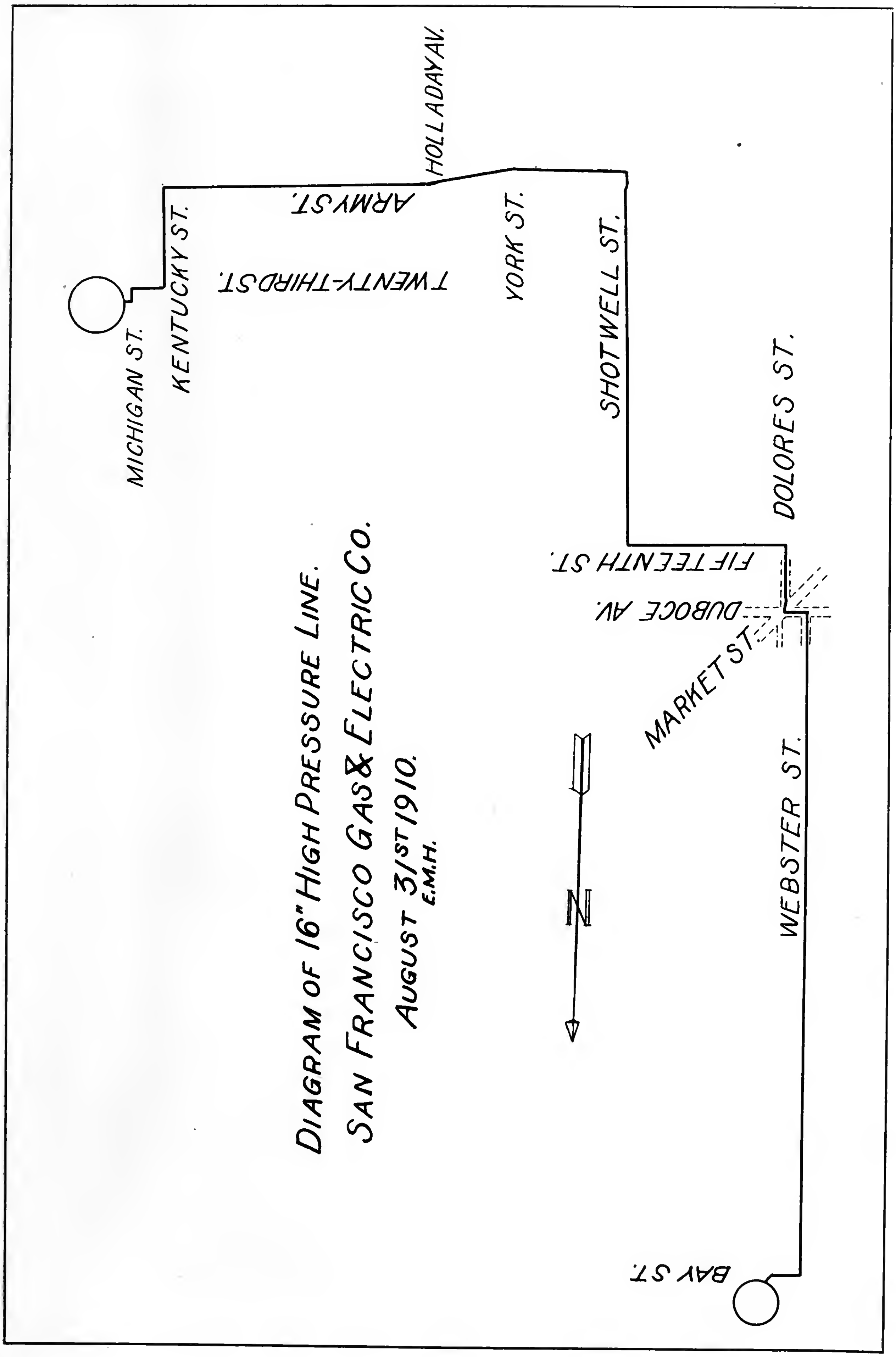
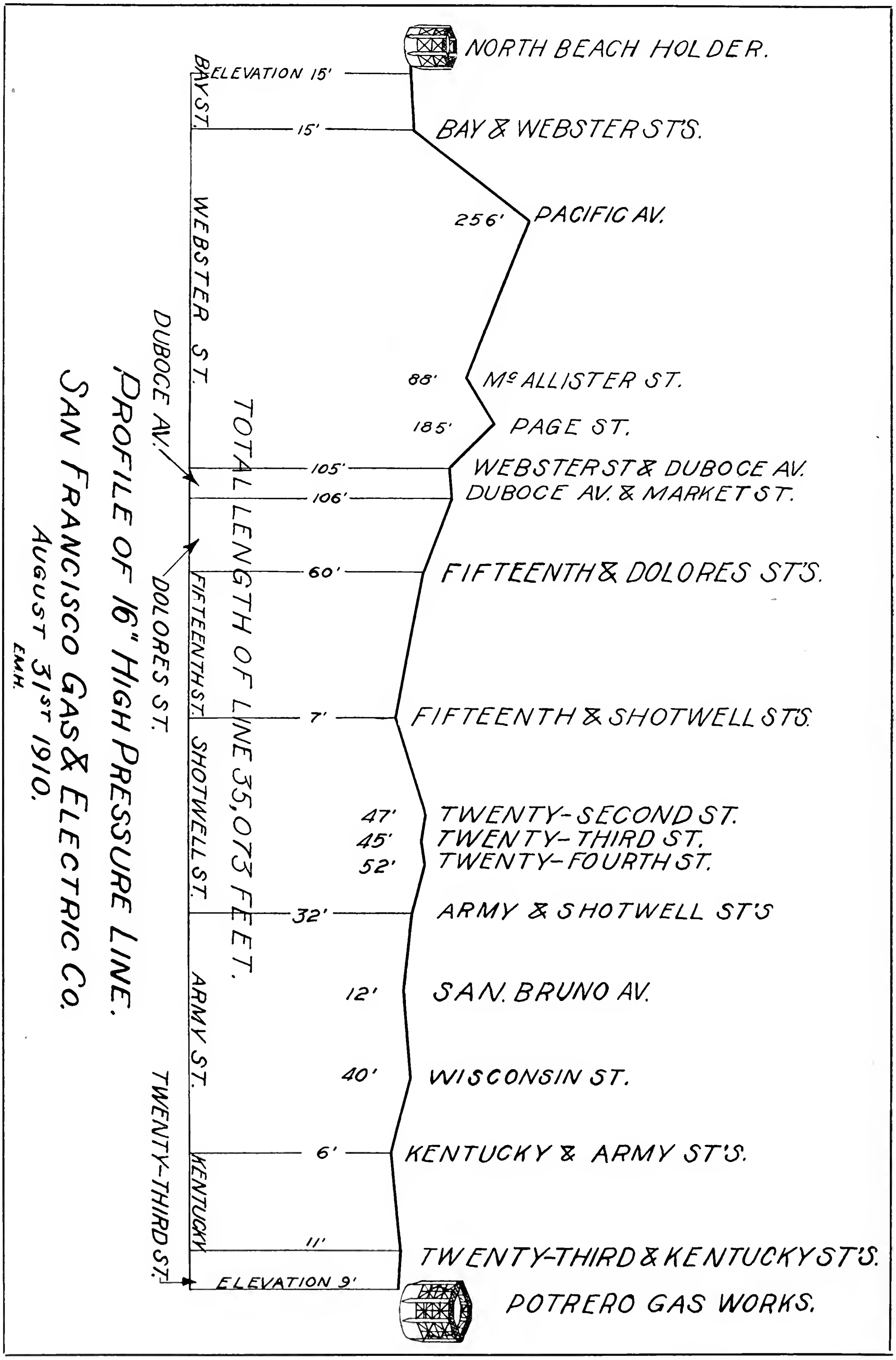


DIAGRAM OF 16" HIGH PRESSURE LINE.
SAN FRANCISCO GAS & ELECTRIC CO.
AUGUST 31ST 1910.
E.M.H.
MICHIGAN ST.
KENTUCKY ST.
TWENTY-THIRD ST.
ARMY ST.
HOLLADAY AV.
YORK ST.
SHOTWELL ST.
DOLORES ST.
FIFTEENTH ST.
DUBOCE AV.
MARKET ST.
WEBSTER ST.
BAY ST.
N

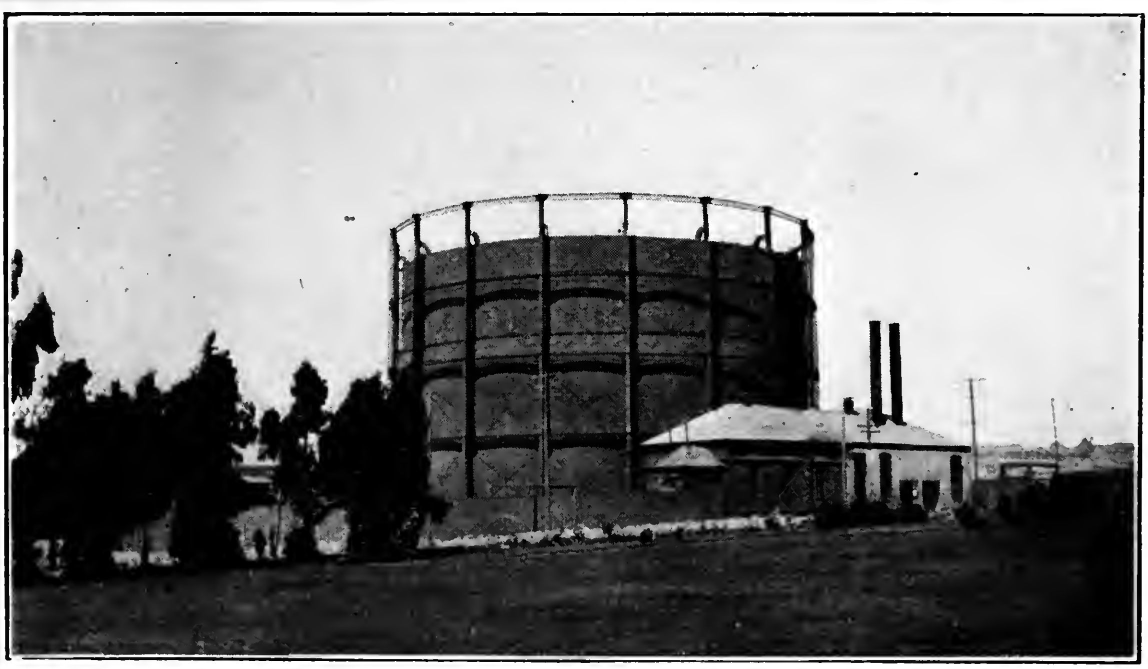


NORTH BEACH HOLDER.
ELEVATION 15'
BAY ST.
15'
BAY & WEBSTER ST'S.
256'
PACIFIC AV.
WEBSTER ST.
88'
Mc ALLISTER ST.
185'
PAGE ST.
DUBOCE AV.
105'
WEBSTER ST & DUBOCE AV.
106'
DUBOCE AV. & MARKET ST.
60'
FIFTEENTH & DOLORES ST'S.
DOLORES ST.
FIFTEENTH ST.
7'
FIFTEENTH & SHOTWELL ST'S.
SHOTWELL ST.
47'
TWENTY-SECOND ST.
45'
TWENTY-THIRD ST.
52'
TWENTY-FOURTH ST.
32'
ARMY & SHOTWELL ST'S
ARMY ST.
12'
SAN. BRUNO AV.
40'
WISCONSIN ST.
6'
KENTUCKY & ARMY ST'S.
KENTUCKY
TWENTY-THIRD ST.
11'
TWENTY-THIRD & KENTUCKY ST'S.
ELEVATION 9'
POTRERO GAS WORKS.
TOTAL LENGTH OF LINE 35,073 FEET.
PROFILE OF 16" HIGH PRESSURE LINE.
SAN FRANCISCO GAS & ELECTRIC CO.
AUGUST 31ST 1910.
E.M.H.

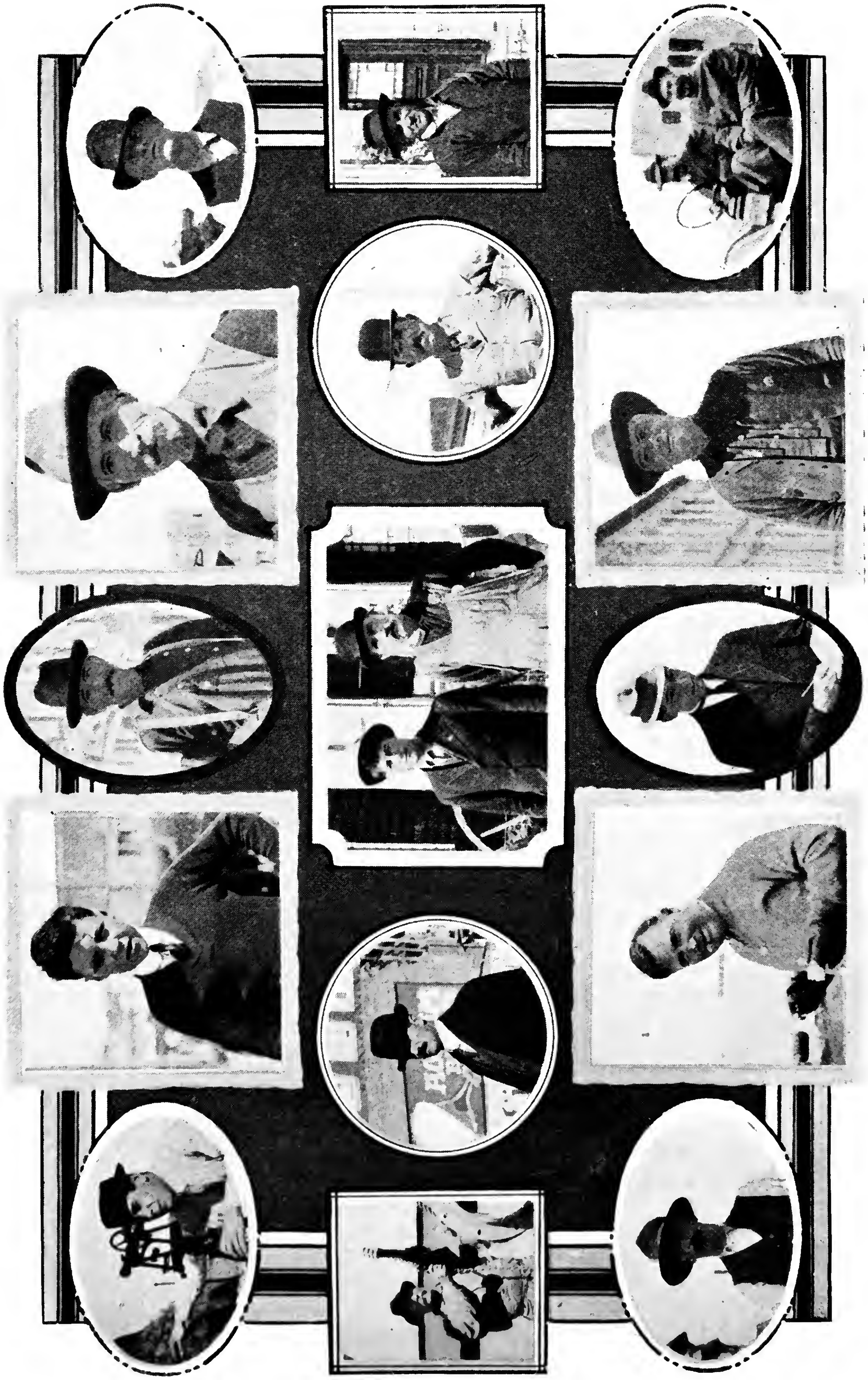
This paper would be incomplete without a reference to the actors in these scenes—the men who carried the work forward so quickly and so successfully.

At the very beginning credit must be given to the laborers. Every engineering project planned for the comfort or convenience of mankind calls first upon the man with a pick and shovel; it is he who smooths the way and lays the foundation. Two hundred and forty laborers were employed, and the pipe was laid in forty-nine working days, or at the average rate of 715 feet per day. Upon nine occasions the daily run exceeded 1,000 feet. The shortest day's run was 328 feet, and the longest 1,255 feet. To appreciate the significance of these figures the fact must be borne in mind that this main was laid through concrete paved streets of a busy, thickly populated city; vehicular and street-car traffic was a serious hindrance; every street crossing had to be bridged, and free access allowed at all times to fire plugs; the work had to be carried on so as not to blockade entrances to public buildings and hotels, nor to interfere with driveways to private residences, stores and industrial establishments; cross walks had to be guarded with hand rails and a constant watch maintained to prevent reckless

Blacksmith Shop at Shotwell and Twenty-fifth Sts.



Gas Holder, Bay and Buchanan Streets



E. J. Riordan
J. McCluster
G. McLaughlin

Frank Walker
K. L. Smissaret
Wm. Cole

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B. W. Bosley

John Toland
Dan Manning
Peter Kearns

Thos. McCarthy
J. von Aspern
A. B. Maguire and P. J. Gartland

drivers, and careless or crippled pedestrians from falling into excavations or stumbling over tools, material or other obstructions.

Below the surface the difficulties encountered were more serious.

In the Potrero and along Army street, the trench was cut through stretches of close-grained granite extending in length from a few hundred feet to half a mile.

Along Webster street for a distance of three miles the soil is composed of fine sand which, having been disturbed by many previous excavations, has little more stability than water. Added to the delay occasioned by walling the trench with planks, every man engaged upon the job suffered from the annoyance and irritation caused by loose sand being blown in his face and eyes and even through his clothing by the strong westerly trade wind.

Between Kentucky and Bay streets twenty-four active street railways and five steam railways were crossed and the rails blocked up. Several abandoned cable road beds were cut through, and innumerable foreign mains, services, conduits, and sewers were encountered, which, if they could not be raised or lowered, had to be tunneled under, as there was seldom sufficient space between them and the surface of the ground to allow the passage of a 16-inch pipe.

Beating down all barriers, and through all obstructions, a clear passageway two feet in diameter was hammered and wrenched and torn; encased in a fragile skin of enamel that necessitated careful handling, the main was laid in place; the trench was filled, pavement restored, and superfluous material removed, the entire operation being carried on with military order and precision at a uniform rate of more than 700 feet in every eight-hour day.

Photographs are presented of the foreman, under whose skillful management this result was attained.

THE following editorial from the Nevada City Miner-Transcript is gratefully acknowledged.

The Pacific Gas and Electric Company some time ago started a magazine with the title of the Pacific Gas and Electric Magazine. It is issued monthly and its obvious aim is to maintain an interest and high condition of intelligence among its army of employes. The company evidently a long time ago came to the conclusion that success can be achieved only by united and harmonious effort, and the magazine is intended to incite interest and harmony from the highest official to the most menial employe.

The benefit accruing from such a magazine is inestimable. It creates a community of interest among the employes, for one thing. It prevents friction and dissatisfaction. There is better understanding all around and this condition results in a more efficient service. The company has the good-will and co-operation of its employes instead of their concealed enmity. Its treatment of its men enables it to appeal to them night or day with the certain knowledge, whatever the conditions, that there will be a prompt and hearty response.

The plan is much better than that adopted by some large corporations of providing a fund to fight their employes in the event of emergency. It is based on the old principle that prevention is better than cure.

The Supreme Court has given judgment against the City of Alameda and in favor of one Martial Davoust, in the sum of $5000, for the death of Davoust's wife some five years ago by coming in contact with a live wire which had fallen on the streets. This establishes the liability of municipalities, which has not heretofore been considered a part of its possible risks in operating public utilities.

Pacific Gas and Electric Magazine

PUBLISHED IN THE INTEREST OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - - - - EDITOR
A. F. HOCKENBEAMER - - - BUSINESS MANAGER

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PACIFIC GAS AND ELECTRIC MAGAZINE
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VOL. II DECEMBER, 1910 No. 7

EDITORIAL

THE CLOSE OF THE YEAR 1910, the first decade of the Twentieth Century, and a decade marked by extraordinary conditions in and about the bay of San Francisco, brings up in the holiday season the thoughts, not so much centering upon itself as upon others. The Christmas season, initially one dealing with Christian faith, has become a time of rejoicing for all people. "Peace on earth and good will toward men" should not be an idle greeting, but should emanate from the heart.

To the men and women of the Pacific Gas and Electric Company, scattered throughout the wide domain of North Central California, the company desires to extend its appreciation of their efforts during the past year, to the betterment of the company's interests, and for the zeal and loyalty everywhere displayed.

Aside from the ordinary routine of the company's business, many enterprises of great importance have been initiated and carried on.

The aim of the company has been, during the year, to not only produce sentiments of its service, but to meet the growing demands from the various enterprises which have started in California.

In all of this year willing hands and active brains among the employees have assisted in bringing about the results desired.

For each and every one of them, the Editor in the words of Henry Van Dyke, desires to say, "I am thinking of you today, because it is Christmas, and tomorrow because it will be the day after Christmas, I shall still wish you happiness, and so on clear through the year."

Division superintendents and district managers should realize impressions made upon the public by the attractiveness of the surrounding properties of the company. A good example is the San Mateo substation, the windows of which are equipped with outside boxes in which are growing bright red geraniums and the sidewalk space being ornamented with a lawn. Another example is the front yard effect of the Mountain View substation, the most artistically arranged and the most attractive looking station in our entire division. In all the larger and most successful commercial settlements in this country and in Europe the influence of the flower garden has been found a benefit to the workmen. Such things in themselves do not prosper, and the effect produced on the employees must be that of a feeling of pride that makes most of them a little more effective in their work. All heads of departments should vie with each other in endeavoring to make their particular plants and offices more attractive by a little adornment.

Station meters for measuring the gas manufactured at Napa, Vallejo, Woodland, Colusa, Grass Valley, and Marysville have been ordered.

The increasing number of automobiles, both gas and electric, in the Oakland district, have necessitated the erection of a garage building for the company's own use on the southeast corner of Second and Washington Streets.

Eugene Cahill, operator of the gas works in the Colusa District, was married on the evening of December 13th, 1910, to Miss Freda Carson, both residents of Colusa. The wedding was a quiet affair, and after a week's honeymoon they have returned to Colusa.

Work on the new substation for the 60,000-volt transmission line from Meridan to Colusa is progressing rapidly. The foundation and framework with sheet-metal covering is now completed.


ROOMS ROOMS
THE RALPH

He Found Opportunities

THIS is a little article on a young man who works all day, and is taking some of the night for opportunities that many another does not use. Adolph C. Postel is employed

in the auditing department of the Pacific Gas and Electric Company in San Francisco. His schooling had progressed as far as the completion of the course in the Pacific Heights Grammar School. A man may increase his muscular development; he may expand his mental equipment. But he can do neither without exercising the organs. The profession of the law or of medicine has been the ambition ahead of Adolph C. Postel, and he has had in mind the earning of money necessary to carry him through a college course. So by night he has been attending the Humboldt Evening High School. He is now in his senior year, and is the president of the student body, consisting of one hundred and fifty persons.

As ability to talk extemporaneously is a particularly valuable asset to the lawyer and a help in almost any business, Postel joined the debating society. The Humboldt Evening High School is affiliated with the Debating League of California. In the contest of Saturday, November 19th, 1910, representatives from the Berkeley High School, the State Institute at Berkeley for the blind, the Mission High School of San Francisco, the Lowell High School of San Francisco, and the Humboldt Evening High School, debated the subject of how best to enlarge and develop the American merchant marine. A large silver loving-cup was offered as a prize for the best individual argumentative speech.

The judges awarded that cup to Adolph C. Postel.

What he has done might not be possible of accomplishment to all young men similarly placed, but that he has found time for the doing, and to improve himself, is a little moral for others.

Meter Boards for Apartment Houses, Hotels and Office Buildings

ELECTRIC METERS

By F. J. SOUTHERLAND


F. J Southerland

WIRING PLANS where a number of electric meters for tenants are to be installed, often give slight consideration to the location of the meters. Whenever the architect has not named in the specification a location for the meter boards, the contractor has naturally chosen places involving the smallest outlay in bringing the wires to them. Since each meter serves a definite part of the building, this practice has resulted in the placing of electric meters in the halls or janitor's cupboards of each floor, or even in the respective suites of rooms.

So many are the types of buildings and arrangements of floor plans, it is but fair to state that even such a haphazard method as that just outlined has occasionally resulted in good meter locations. The expression, a good location, means one which not only conforms to the insurance and other rules governing the installation but which also assures mutually to the owner and tenants and to the company the greatest freedom from interference in reading, testing, installing or removing these appliances.

The illustration on the opposite page shows a recent installation of eighty electric meters in the Atherstone Apartments.

The service mains are here enclosed in iron conduit and fittings, up to the cut-out blocks of the individual meters. On the "load" side, the wires leave another cut-out to enter an iron conduit through which they are conducted to the fixtures and outlets in the rooms. The meter board is of wood, painted black, and is mounted on substantial vertical supports in the basement of the building. The simplicity and effectiveness of such an arrangement is at once apparent.

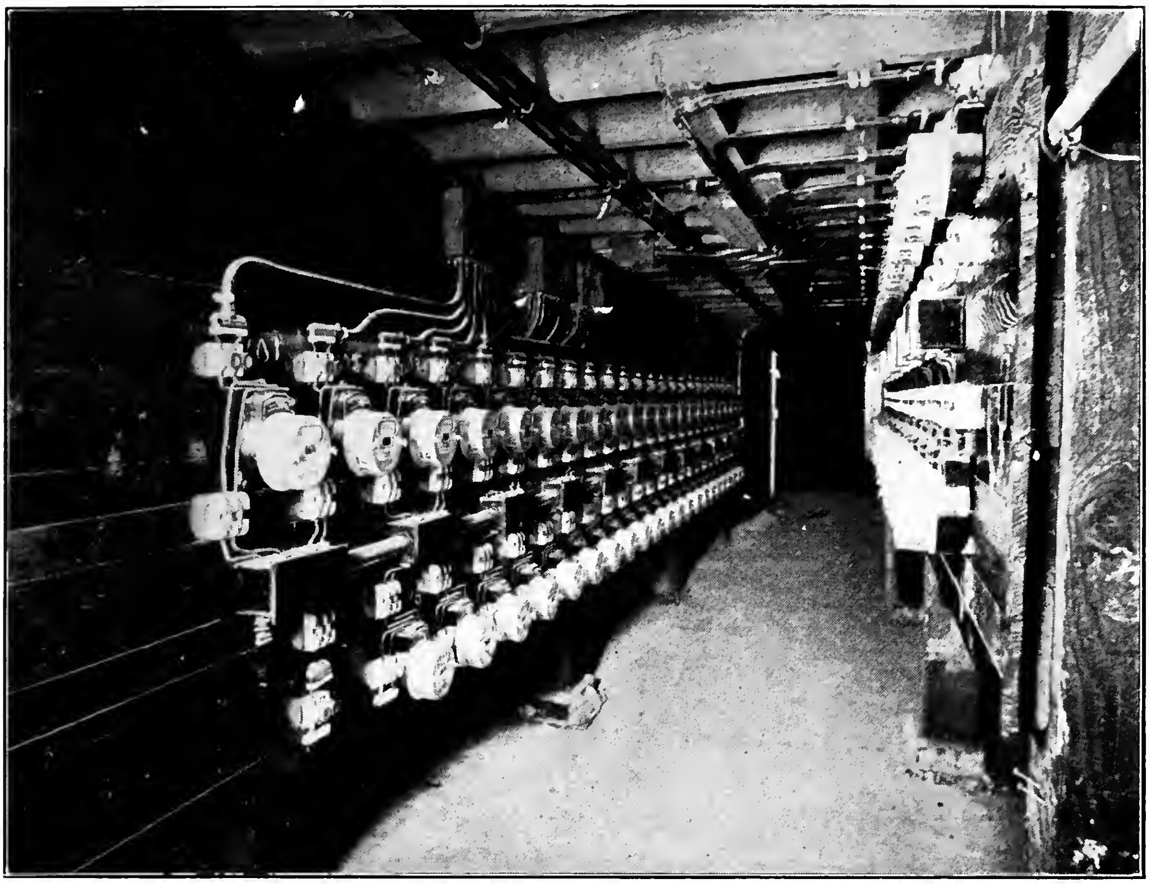
GAS METERS

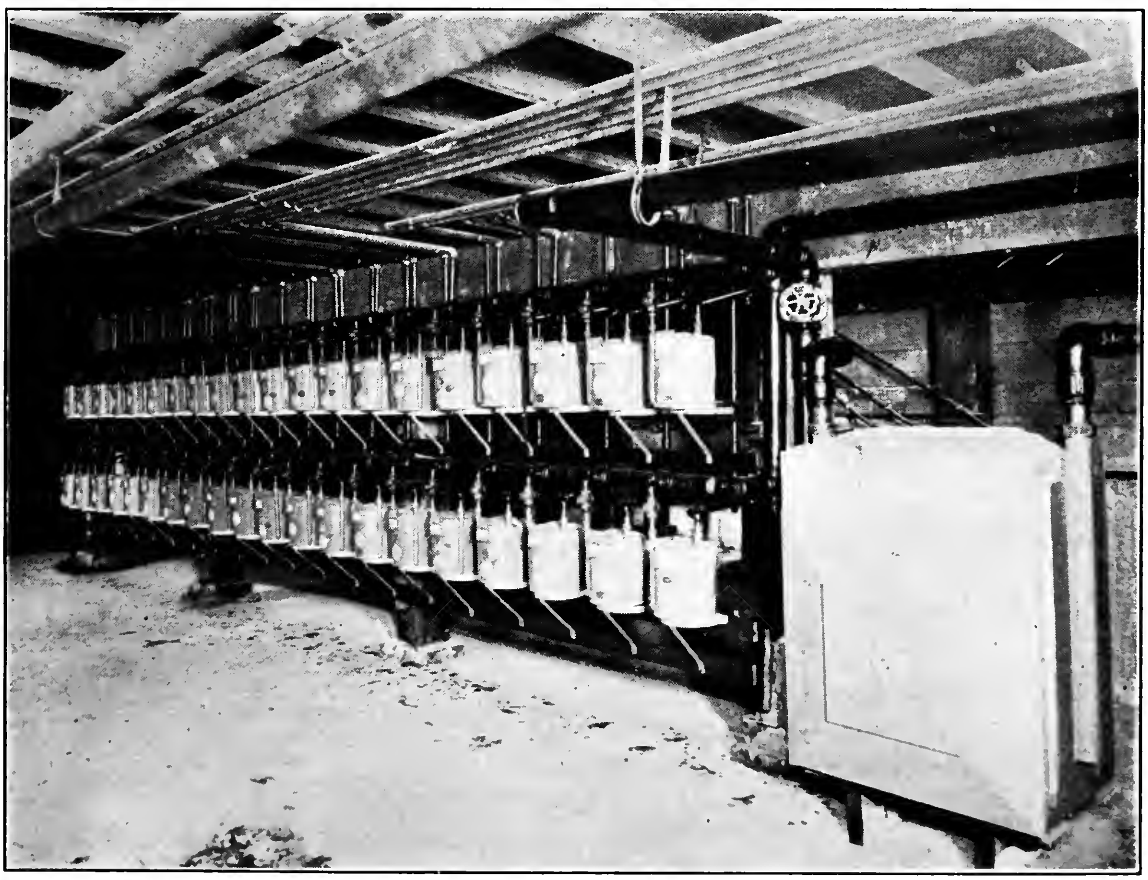
By D. E. KEPPELMANN


D. E. Keppelmann

THE ACCOMPANYING illustration shows the present method of gas meter installations in San Francisco. The installation is a 200-light meter supplying forty 5-light intermediate meters, being one of two series installed at the same location. The writer wishes not only to call attention to the uniformity of connection, but its practicability as well. It will be observed that instead of the usual lead connections, iron connections were used entirely. With a horizontal swing joint on the inlet connection and both a horizontal and vertical swing joint on the outlet connection, connected in this manner, iron, having the flexibility of lead has its great advantage in the little or approximately no cost for maintenance. Lead connections are not only easily trapped but become bent and kinked, closing off the supply of gas. With iron, the connections are installed to fit the meter, the swivel facing on the spud of the meter exactly, thereby eliminating all strains, pulling spuds being an impossibility. At the end of each rise a tee with plug outlet was put on instead of an elbow, which not only gives access to all house piping in the event of obstructions but eliminates the necessity of disconnecting the meter for registering test.

The cost of labor and material, installing with iron instead of lead is necessarily more, in a single installation; however where a number of meters are installed the labor amounts to very little more, the maintenance practically nothing; insuring an uninterrupted supply of gas, provides against leaks, causing less annoyance to the consumer and considerably less cost to the company.





Electric and Gas Meters in the Atherstone Apartments, 545 O'Farrell Street, San Francisco

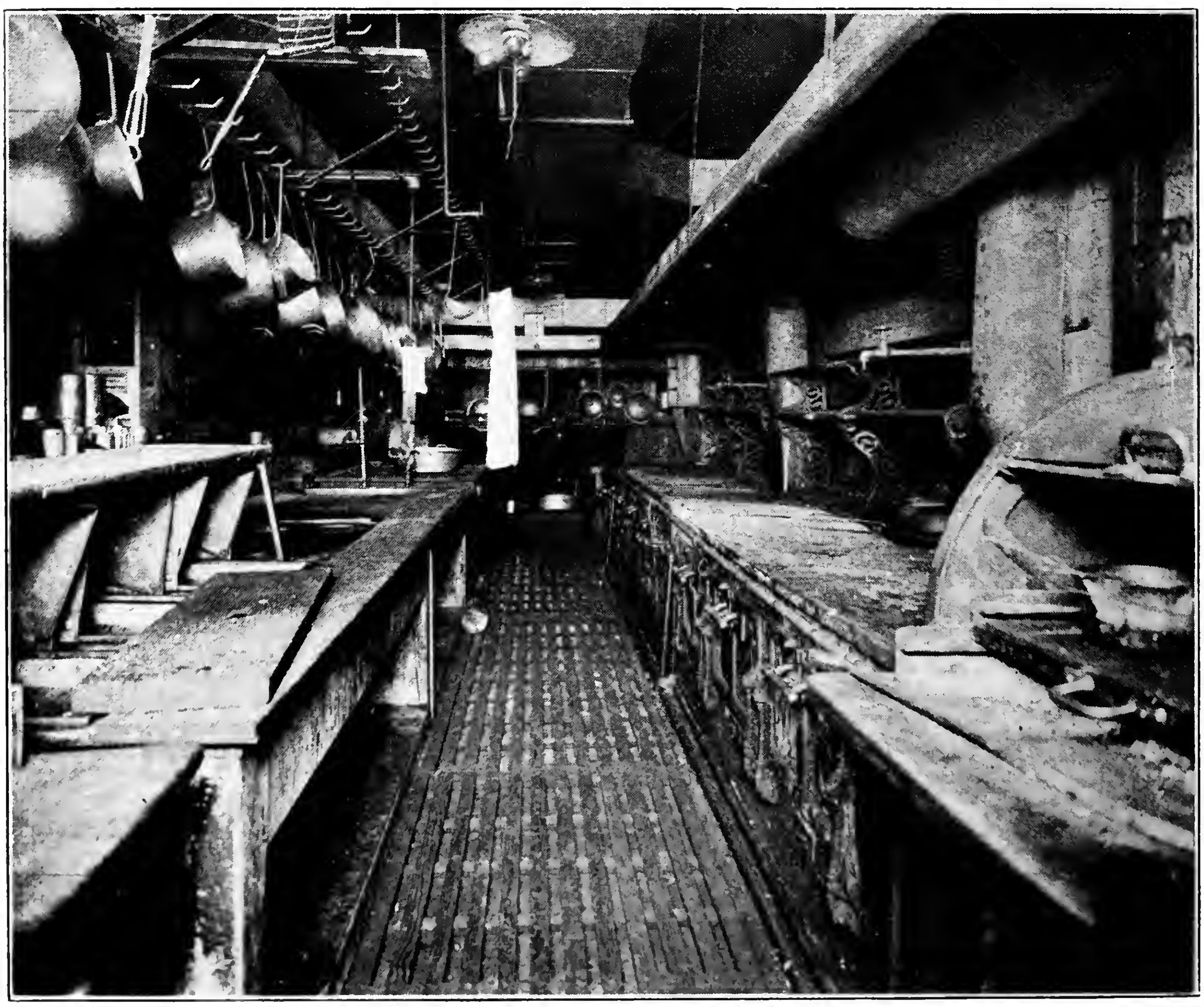
Gas in the Hotel Kitchen

A STRIKING example in the possible economies and advantages of a properly planned hotel kitchen using gas for fuel in preference to oil or coal, is afforded by the experience of the Hotel Manx, in Powell and O'Farrell Streets, one of San Francisco's most popular hostelries.

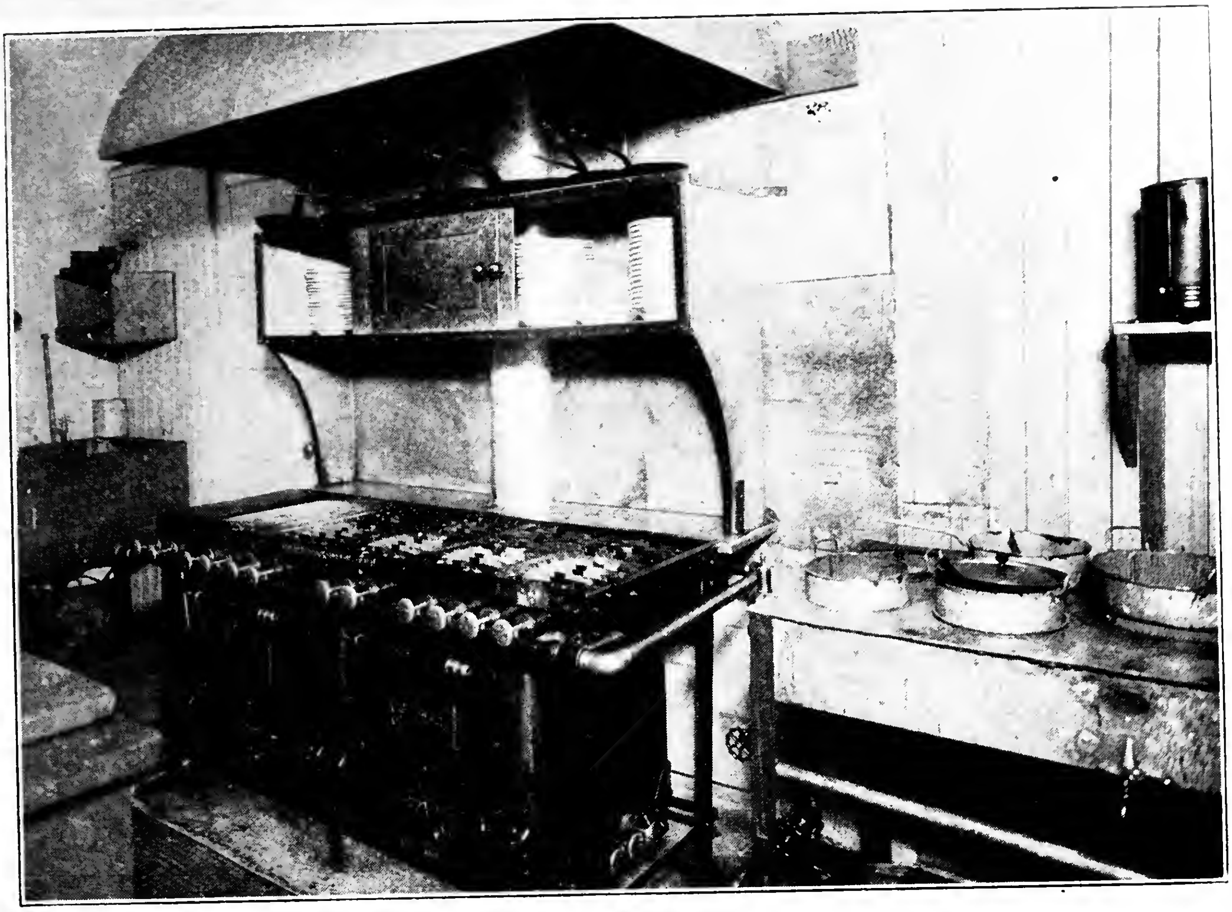
The accompanying photographs shows the discarded oil installation as originally installed in the kitchen of this hotel.

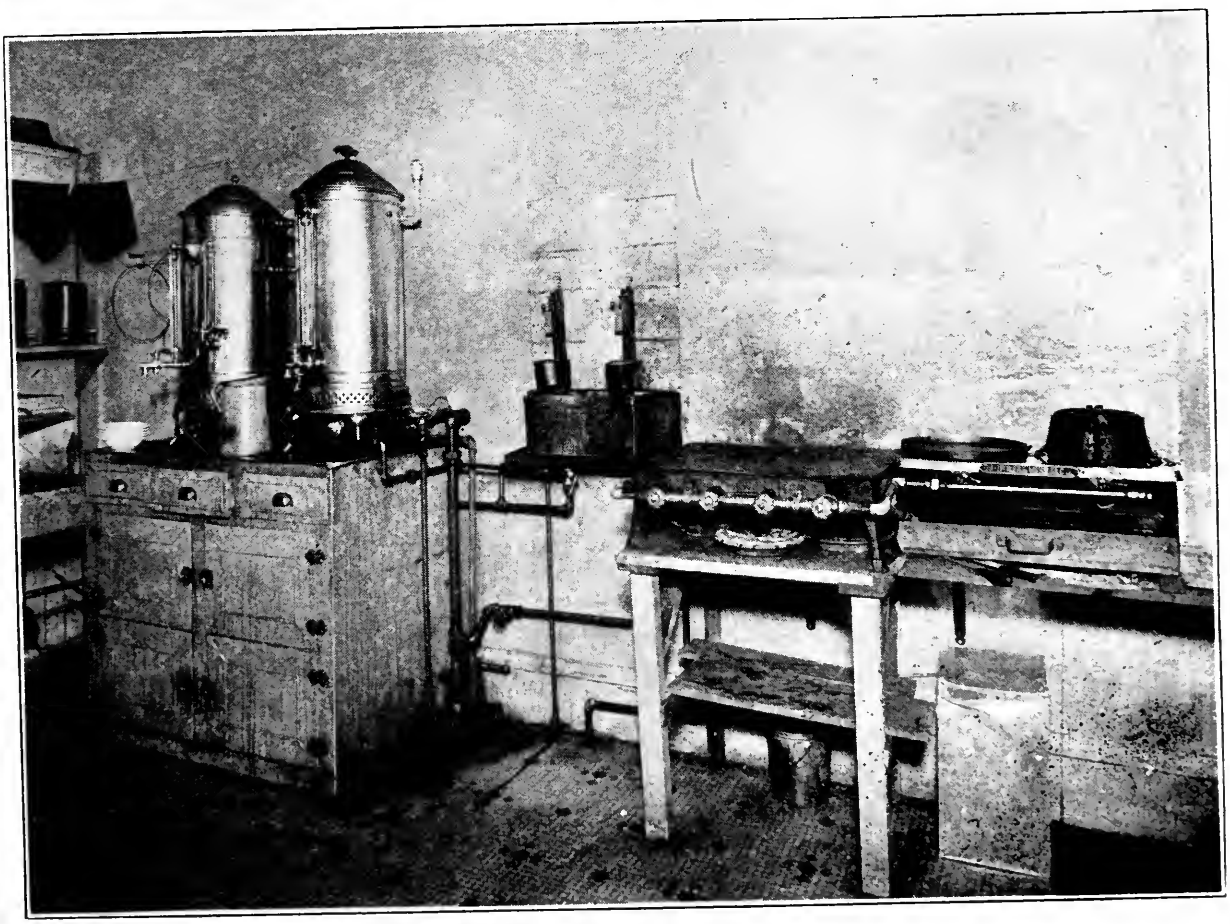
This installation of crude oil burning ranges originally cost approximately $2,000. The gas appliances—ranges, hot plates and heaters, cost $300. The average cost of crude oil per day under the old system was $1.85, or a total monthly of $55.50. The average cost of gas for the new equipment is $32.00 per month.

Under the oil system the total number of employes in this department of the hotel was 27—since the installation of the gas equipment this force has been reduced to 7. The number of daily diners at this hotel averages 400, and while the dining room under the old system, similar to most hotel dining rooms, was run at a loss, the same dining room, serving the same number of people, under the present efficient management of Mr. Homer Dobbins and with the assistance of the fuel gas appliances shown in cuts on opposite gas appliances shown in the illustrations on the opposite page, is now operated at a profit.



Kitchen of the Hotel Manx before oil-burning ranges were discarded





The same kitchen, showing the complete gas installation

For Chico contracts have been let for a new storage holder, having a capacity of 100,000 cubic feet.

In Oakland contracts have been let for two sixteen-foot station meters for measurement of gas manufactured.

The cities of Roseville, Folsom, Loomis, and Newcastle have entered into a contract with the Pacific Gas and Electric Company for street lighting.

The General Electric Company report that orders for turbo-generators, aggregating 280,000 kilowatts, have been scheduled by its factory for delivery between May and October, 1910.

Owing to greatly increased business the H. W. Johns-Manville Company announces the removal of its offices, now located at 85 Sheldon street, Houghton, Mich., to more commodious and convenient quarters at 96 Sheldon street, where they will be better prepared to serve their patrons.

As in the past, Mr. S. T. Harris, who has been associated with the company for a number of years, will be in charge of the offices at the new address.

Mr. E. J. Kendall, for several years general superintendent of the Snow Mountain Water and Power Company, with headquarters at Ukiah, leaves that company on the first of January to engage in business below, being succeeded by W. S. Graham of San Francisco.

Mr. Kendall has been with the Snow Mountain Company during practically all of their construction period, having extended the company's lines through Mendocino, Sonoma and Napa Counties.

Director Dana Durand reports the following population, by counties, of California:

Alameda	246,141
Alpine	309
Amador	9,086
Butte	27,301
Calaveras	9,171
Colusa	7,732
Contra Costa	31,674
Del Norte	2,417
Eldorado	7,492
Fresno	75,657
Glenn	7,172
Humboldt	33,857
Imperial	13,591
Inyo	6,974
Kern	37,715
Kings	16,230
Lake	5,526
Lassen	4,802
Los Angeles	504,131
Madera	8,368
Marin	25,114
Mariposa	3,956
Mendocino	23,926
Merced	15,148
Modoc	6,191
Mono	2,042
Monterey	24,146
Napa	19,800
Nevada	14,955
Orange	34,436
Placer	18,237
Plumas	5,259
Riverside	34,696
Sacramento	67,806
San Benito	8,041
San Bernardino	56,708
San Diego	61.665
San Francisco	416,912
San Joaquin	50.731
San Luis Obispo	19,383
San Mateo	26.585
Santa Barbara	27.738
Santa Clara	83,539
Santa Cruz	26 140
Shasta	18,920
Sierra	4.098
Siskiyou	18.801
Solano	27,559
Sonoma	48.394
Stanislaus	22,522
Sutter	6,328
Tehama	11.401
Trinity	3,301
Tulare	35,440
Tuolumne	9,979
Ventura	18,347
Yolo	13,926
Yuba	10,042
Total	2,377,556

Of this total the Pacific Gas and Electric Company supplies gas, electricity, and water to 1,290,878, or 54 per cent of the entire population of the State.

PACIFIC GAS AND ELECTRIC COMPANY

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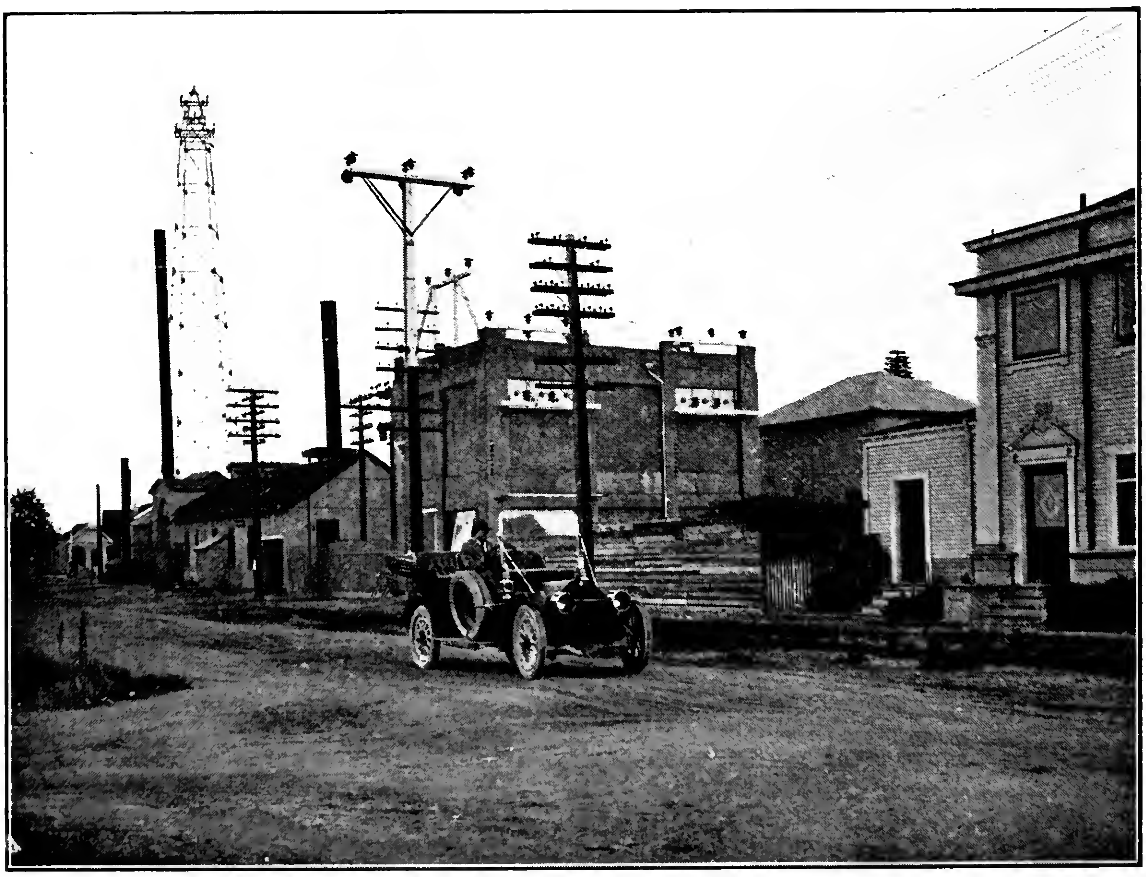
Mountain View Substation, the most attractive on the entire system



Redwood Substation and power-line tower

PACIFIC GAS AND ELECTRIC MAGAZINE

VOL. II JANUARY, 1911 No. 8

Fireproof Substations

By C. F. ADAMS, Engineer of Electric Construction.


C. F. Adams

The problem of how to deliver light, heat and power without "spilling" the goods en route, has always engaged the minds of of transmission men.

Owing to the concentration of apparatus at sub-stations, there are always a large number of possible "spilling" points centered there.

Many of the earlier switching stations and small sub-stations came to grief before the importance of fire prevention was realized. A free high tension arc in a small sub-station is not a proper subject for close attention, in the station.

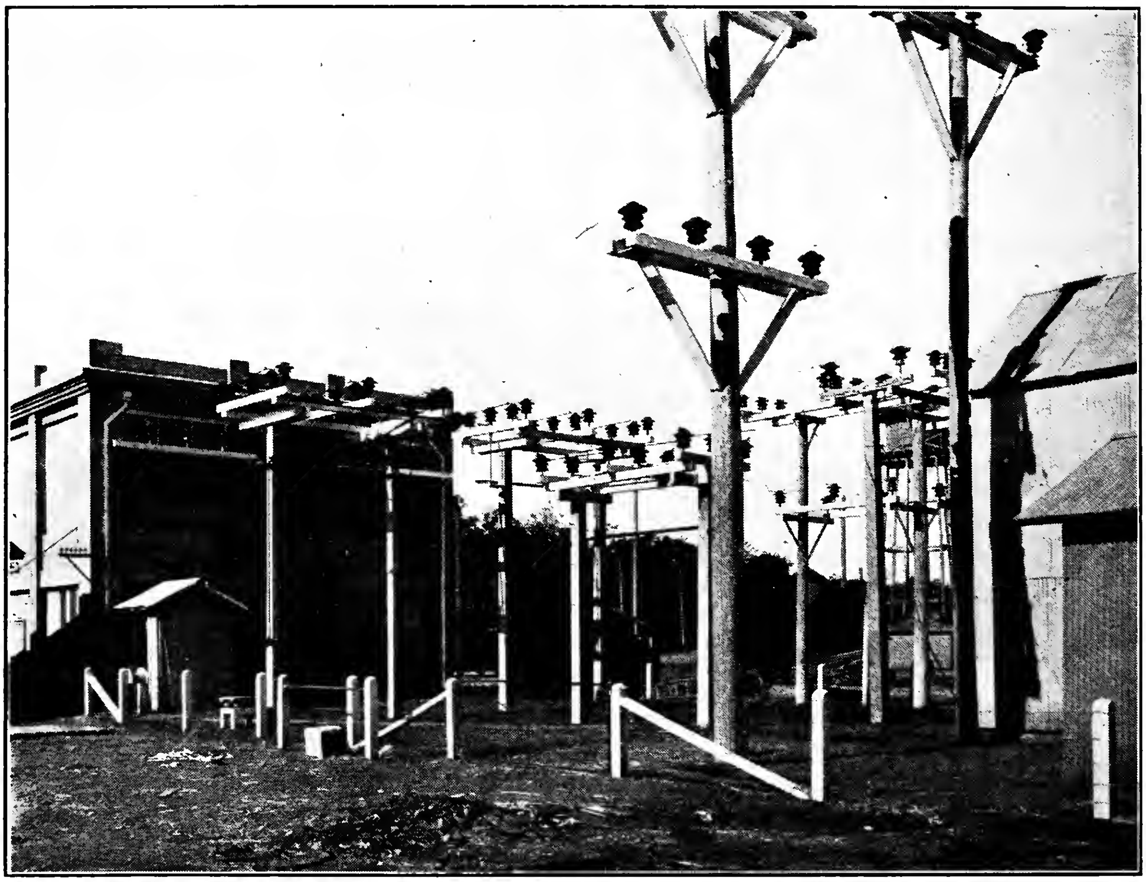
From a study of human impulse, the emergency switches are always located out of doors, and these are generally supplemented by high tension fuses, at stations where an attendant is not on continuous duty. For the past four years, one station after another has been rebuilt and constructed of fire proof material. Reinforced concrete is the material most employed in the more important points. Concrete barriers separate the high tension oil switches, and in some stations they are used as bus partitions also. For the moderate country station, the preferred structure is of galvanized steel mounted on a steel frame, the floor being of concrete.

The concrete station is found to be invulnerable as regards high tension arcs and flame. Galvanized steel stations provide an excellent ground path for a free arc, which generally centers on a limited surface.

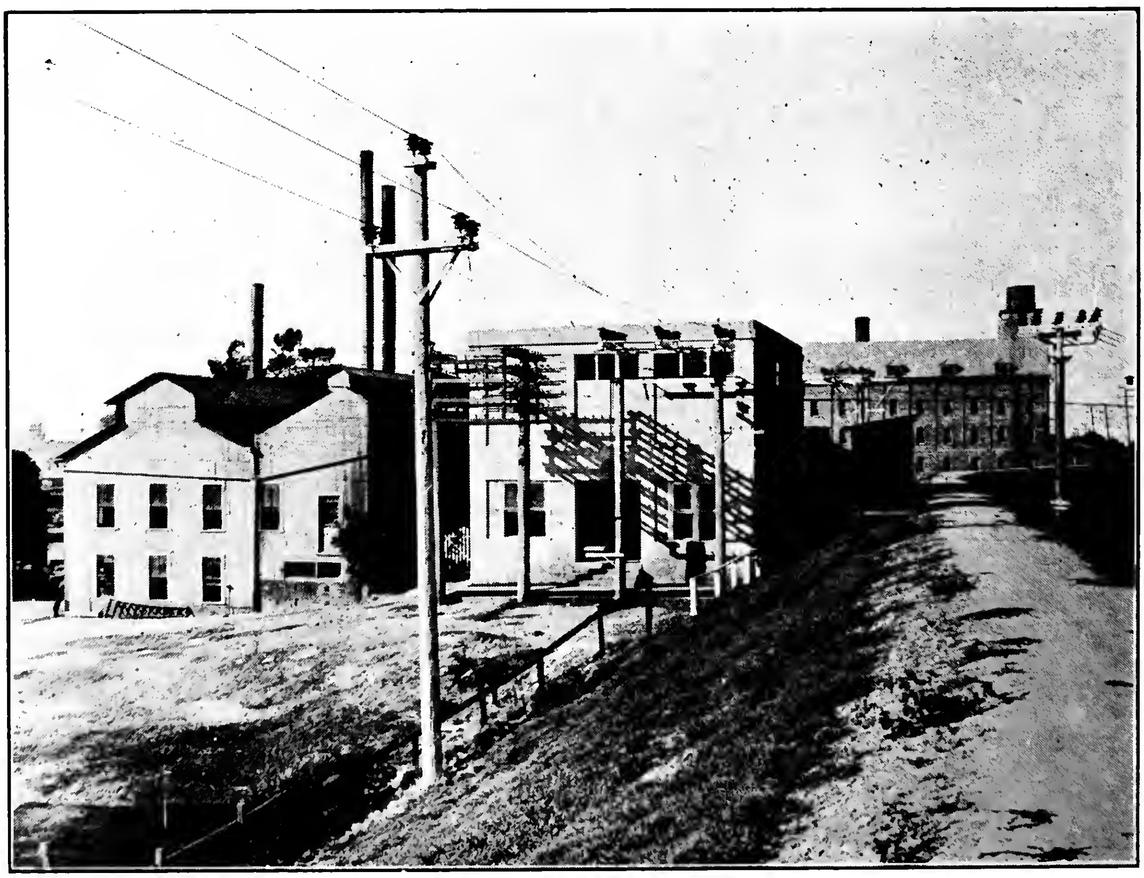
A few holes the size of bird shot through the sheet steel is generally the limit of the damage in a steel building when high tension trouble occurs.

Our technical literature and the discussions of the Institute of Electrical Engineers devote many pages to the subject of fire risk from the use of oil type transformers. Many of the foremost engineers insisted that the station fire risk was directly proportional to the amount of oil involved. General experience always determines disputes of this nature, and the practice of the Pacific Coast Engineers, in avoiding expensive transformer compartments, oil drains, and special transformer fire apparatus has been vindicated by time. Oil cannot burn unless it is very hot, or fed through some form of wick. You cannot overheat several hundred gallons of oil in a few minutes time.

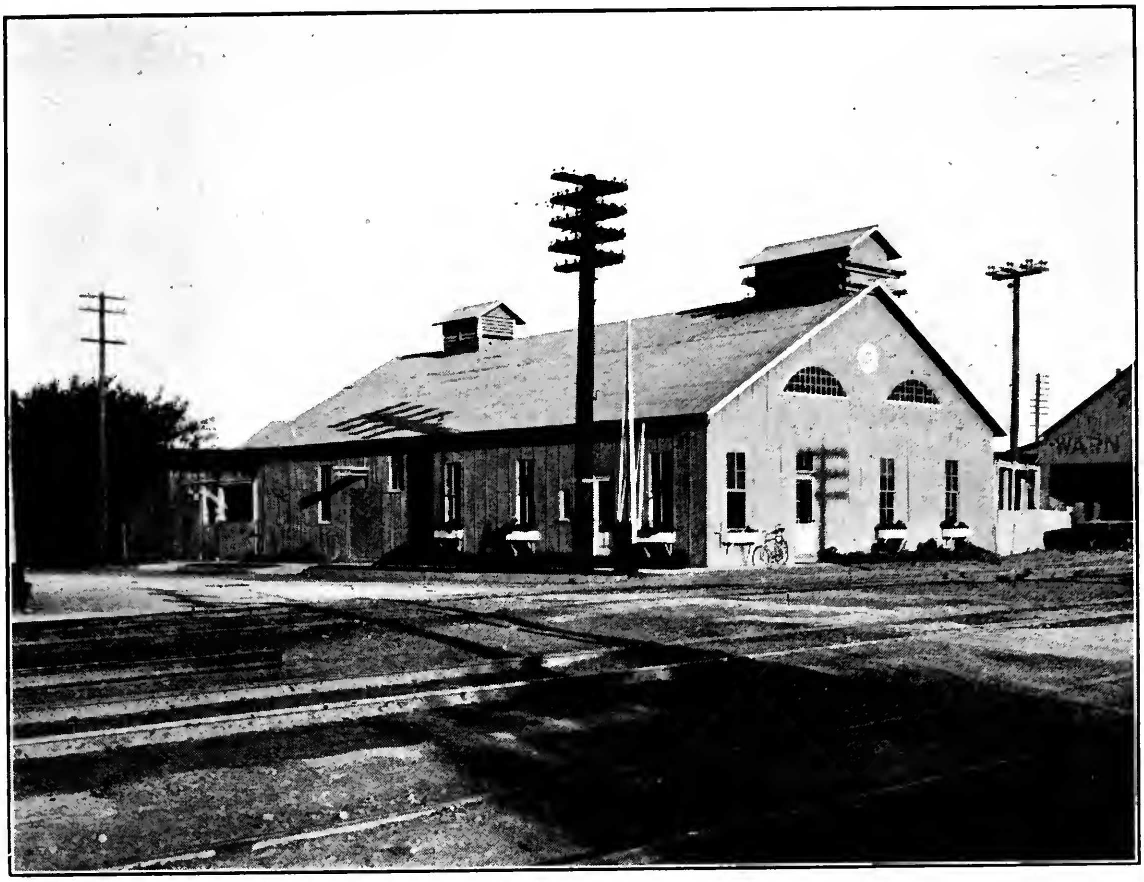
A proper fuse or automatic switch will protect a transformer against much damage from internal short circuit. The absence of external combustible material is the best protection against possible external heat. If there



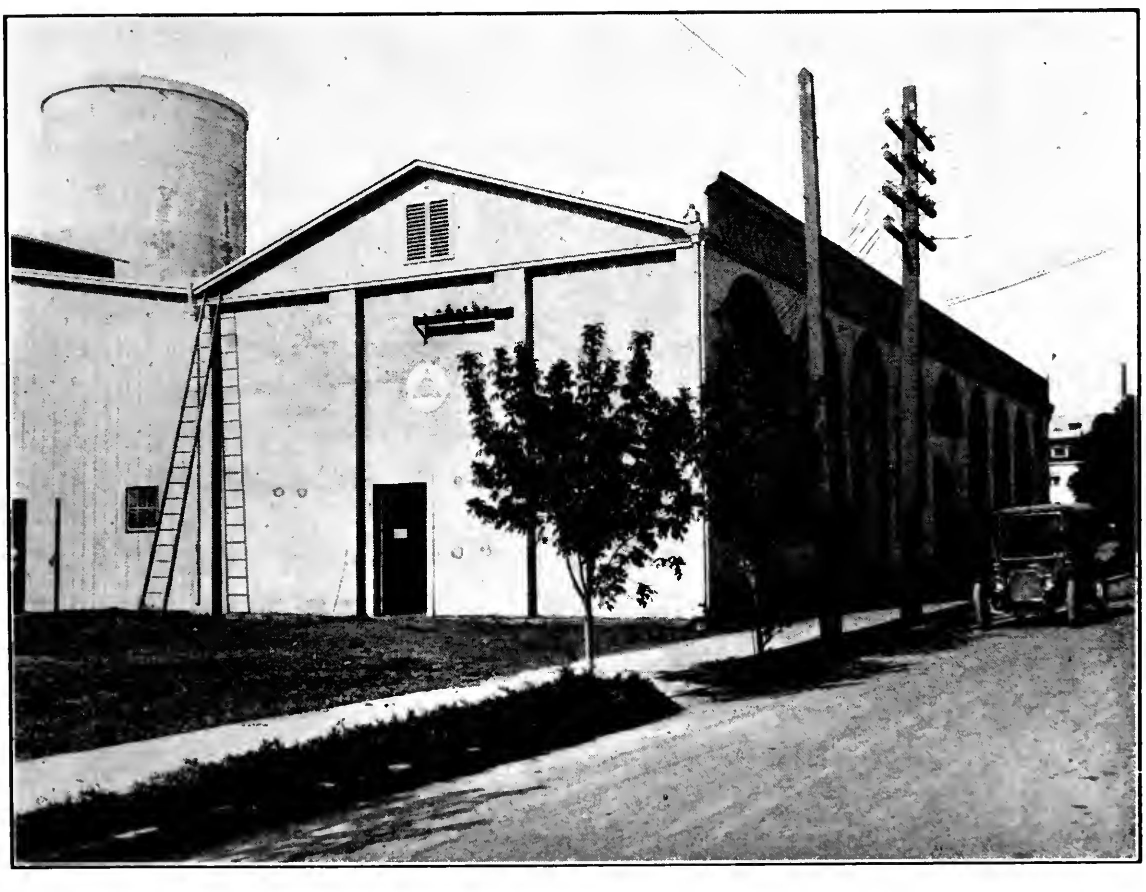
Chico Substation, rear view



Marysville Gas Works, Substation, and the Sperry Flour Mills



San Mateo Substation, on the railroad near the passenger station



Palo Alto Substation, near the railroad

Hammonton Substation, supplying twenty gold dredgers on the Yuba River

is nothing combustible in the structure of a station, transformers require no fire housings.

This general principle has governed the design of stations and their internal arrangement. The accompanying photos show the external line and switching structures, as well as the character of buildings now in use.

Redwood, Marysville, Chico and Mountain View have excellent examples of the compact concrete buildings. Hammontown has a galvanized steel structure, while the stations at San Mateo and Palo Alto, are housed in masonry structures, whose combustible material is limited to roof only.

Of the above concrete stations, Marysville contains five sets of three-pole 60-kilovolt oil switches, being an important switching station. Its transformer equipment consists of six 500-kilowatt units, which supply current for six two-phase circuits for light and power purposes.

Chico station has 1700-kilowatt capacity of transformers, and is also the junction point for the lines of the Northern California Power Company.

Mountain View station contains 1500-kilowatt capacity of transformers supplying current to Palo Alto and Sunnyvale. It is also an important switching station. The industry and taste displayed on the lawn and yard decorations have made this a "Premium station," and the station interior is as well kept as the grounds.

Redwood City station contains six sets of 60-kilovolt oil switches, and a transformer equipment of 1500-kilowatt. Four distributing circuits are operated from this point.

The operating success which has followed the adoption of the fire-proof station is its best recommendation, and all future stations are being planned for the same permanence and high grade service.

Gas Plant Economies

By SHERWOOD GROVER, Gas Engineering Department.

Sherwood Grover

To do justice to this subject one would have to make a review of practically all the proceedings of the various gas association, engineering, and chemical societies down to date. The gas business as it is involves all of the A-B-C's and fundamental laws of both mechanical engineering and chemistry. The writer makes due apology to all who may recognize herein some child of their own individual brain parading in a different suit of clothes or mayhap even nude. No claim is made to originality. Effort will be made merely to treat the subject in a general way. Any original thought, if such there be, will speak for itself.

A gas plant is essentially a chemical manufacturing establishment as much as a powder works or a paint factory. But it differs from them or any other manufacturing establishment in one important feature: in the distribution of the finished product. A gas plant relies on the engineer to handle the product until the time it is delivered to the consumer on the consumer's premises. Other manufacturing plants turn their finished product over to a teamster or a railroad.

From the foregoing fact it also follows that a gas plant is a method of investing capital by which dividends are earned on bonds and stock. After a plant is completed in every detail, ready to deliver gas to the consumer, we may regard it as a kind of grinding mill, into the hopper of which we pour the money to buy the raw products and the labor necessary for the fabrication of the finished article, and from the bottom of which we take the money which we get from the consumers as the price of our finished product. The factor that determines the relation between that which we put in at the top and take out at the bottom is the economy of the plant.

The economy of a plant can best be divided into two branches: (1) The economy of installation or construction. (2) The economy of operation.

As the construction is naturally the beginning of a gas plant, a few of the essential economies of installation will be considered first.

After a territory has been surveyed with a view of installing a gas plant, and the advisability of such installation has been definitely determined, the first economy is the most advantageous location of the gas works. The earliest elementary books on gas business will tell you to locate the works at the lowest point in the territory to be supplied, at the same time having due regard for the most advantageous transportation facilities for your raw material. Although the development of high-pressure distribution has to a certain extent nullified the advantage obtained in distributing from the lower level to the higher, we know that high pressure is limited in its field and therefore this fundamental economy remains unchanged.

In construction the first and foremost economy which can be applied is that of absolute safety. This particularly applies to foundation work. Where there is any doubt as to the kind of bottom which is to be built upon, sufficient work should be done in the way of testing to determine its nature. In the particular case here on the Pacific coast we should add another little factor of safety to cover possible earthquakes. This can best be taken care of in most instances of masonry work by a little extra steel re-enforcement.

The most important economy in the construction of a gas plant, assuming that the design is as near ideal as possible, is in the selection of machinery, and it is needless to say that only the best and most economical should be chosen. All of the latest improved

labor-saving devices as well as those for improving efficiencies of moving machinery should be installed. When the engineer lays out the steam-generating and distributing system, bear in mind all that is best practice in power-plant design; that dry steam is desirable in a gas works, that a steam separator belongs on a gas generator as well as on a high-speed engine. When an engineer has the opportunity to build a complete new plant to suit a given condition, there is no excuse at this stage and development of the gas business for not building on lines of greatest economy. Unfortunately this is not the condition which engineers and superintendents are generally facing in the west. We are developing and have developed a new process to a remarkable degree of perfection. At the same time we are endeavoring to keep pace with a demand for our product, which, I believe, is unparalleled in the history of the gas business. There may be isolated cases of rapid development, but with our case it is general throughout the territory and due to natural growth, and not to any special campaign of advertising or education on the part of the gas company. The ensuing tables are quoted as two examples of this growth in places which widely differ in size. They are the extreme in size of the plants coming under the writer's observation and others could be quoted ranging between the two.

TOTAL SALES PER ANNUM

YEAR	PLANT 1	PLANT 2
1900	227,035,600	
1901	267,662,600	
1902	306,827,600	2,829,700
1903	406,999,600	5,054,000
1904	490,914,700	7,872,300
1905	563,005,600	10,411,100
1906	880,622,800	11,498,600
1907	1,260,852,700	15,074,500
1908	1,394,254,200	17,420,200
1909	1,438,115,280	19,586,300
1910, including August.		15,295,800

The eighteen gas works of the Pacific Gas and Electric Company have passed through the stages of being coal-gas plants, combination coal- and water-gas plants, water- and oil-gas plants. Now we are adding to this list lampblack-gas. This is water-gas made from the lampblack by-product of the oil-gas process, and this lampblack-gas has now reached the stage of its development where a lampblack-gas machine can be designed for a given oil-gas plant to use the surplus lampblack entirely up, thus making a perfect balance.

There may be existent faults of design which by a little study and care can be remedied. The relative positions of the generators, boilers, lampblack separators, and moving machinery should be carefully considered with the following points in view: Where lampblack is used for boiler fuel, the separators must be located with a view of economy in handling. In a small plant where hand labor is used entirely for lampblack it is almost impossible to locate the separators too close to the boilers. In a larger plant, where mechanical handling is the rule, the matter of storage must be considered and location made, so as to supply boilers economically and also the lampblack gas generators. Between the generators and separators the main thing to consider is a short, direct, lampblack drain of ample size, avoiding as much as possible sharp turns which tend to bank up the lampblack, requiring labor to overcome.

The generators, where the greatest amount of steam is consumed, and the moving machinery should both be located to insure the shortest possible steam line to the boilers. But there are in some of the Pacific Gas and Electric Company's plants various minor uses of steam which if not carefully watched are sources of small losses individually. In the aggregate the loss is considerable where steam is used in scrubbers, foul mains, relief-holder drips, and such places. All leads for such purposes should start from the main steam line with a controlling valve so that they contain live steam only when in use. These controlling valves should be so placed or equipped

with extension handles that a man does not have to climb a ladder to operate them.

It would seem unnecessary to emphasize the necessity of properly covering all steam drums, piping, etc., with non-conducting material, but it is a matter which is too often slighted, particularly in the little side extensions of steam piping which are made from time to time. This may be a relic of the time when the disposal of lampblack was a problem and there was a tendency to overlook minor steam wastes on this account. But now, with the production of lampblack practically under control, these minor losses must be guarded against. Such losses consist in the transfer of heat from the steam to the air. This loss is directly proportional to the difference in temperature. Other things being equal, the higher the temperature of the steam the greater the loss. The insulation of pipe lines should not be confined to those carrying live steam alone, but also should be carried out on the exhaust pipe, feed-water heaters and piping, oil heaters, and oil pipe from heater to generator. In connection with oil heaters, where exhaust steam is used, their design should be such as to avoid back pressure; otherwise it may be that the advantage obtained by using exhaust steam is more than balanced by the effect of the back pressure on the moving machinery. A well-insulated, live-steam oil heater has many points to commend it, not the least of which is the fact that it will maintain constant temperature of the oil under any prolonged or varying pull. This is one of the features in our gas works which varies from plants wherein water gas is made. We must heat nearly three times as much oil for each thousand feet of gas made, and that gas of a kind more difficult to handle.

Scrubber and relief holder connections are of special importance in oil-gas making. The process, as developed today, differs from water-gas making in the speed of generating and has a decided peak movement during this time of actual generation. Therefore to take advantage of this peak and prolong its duration is to our advantage. By so doing the output and efficiency of the generator is increased.

The most important factor to consider in obtaining this result is the resistance of the foul main, the scrubber and relief-holder connections. These should be of generous proportion, avoiding sharp turns as much as possible, but, where necessary, they should be provided with crosses or hand-hole elbows equipped with quick-opening doors, giving an opening the full size of the main, and also affording a gas-tight fit when closed. This permits thorough cleaning in the shortest possible time.

Another little feature which is peculiar to oil-gas is the fact that the crude gas holds in suspension a certain quantity of microscopic lampblack which any amount of ordinary scrubbing fails to throw down. It does deposit in the oxide and affects the life of the material and retards to a certain extent its efficiency. This fault has been overcome by the installation of a washer on the outlet of the relief-holder, of a type known as "ammonia washers," of which there is on the market a number of slightly varying designs. The feature of these washers is, they force the gas to pass through the water in a finely divided state and precipitate the lampblack.

Leaving the manufacturing end of the business and taking up distribution we find that a great many plants are a combination of low and high pressure, the high being an auxiliary of the low-pressure system. In such installations there is one important tendency to be guarded against; the low-pressure system is inclined to throw most of the load on the high-pressure. If not watched this will eventually result in an installation which is top heavy, with the high pressure doing most of the work. This condition is partly a result of growth and extensions to the high-pressure mains without corresponding development of the low-pressure. Also it is due to the regulators feeding from the high into the low-pres-

sure system being set to a given pressure. Unless adjusted daily, the regulators maintain their pressure throughout the twenty-four hours. And they assume the night load, if they are set for a pressure equal to that given by the storage-holder, which is generally the case. If set for a pressure above that of the storage-holder, still more work will be thrown on the high-pressure system, and the amount of this extra work varies with different conditions, the greater the distance between storage-holder and regulators and the smaller the size of low-pressure mains, the less the amount of work thrown on the high-pressure system.

The writer believes that the field of high-pressure distribution has been definitely determined and its application limited to suburban districts and other widely scattered territory. There a low-pressure system would be prohibitive in cost, especially where growth is not rapid.

Where high-pressure feeders are in use to supply out-lying territory contingent to cities and also are used to boost up weak places along the line, the low-pressure system should be extended to relieve the high-pressure feeders as the intervening territory fills up. By so doing the installation of compressors can be kept as small as possible consistent with the development of a given community.

Take for example a city or town which has outgrown the low-pressure system, a town which is alive and will keep on growing and it needs a new main feeder or feeders. Figure out the cost of low-pressure mains; then of equivalent high-pressure mains, say 20-pound pressure, feeding in at every intersection. It must feed in at every intersection to be the exact equivalent of the low-pressure. This means manhole and regulator at each intersection. Add to this the cost of compression plant and you will find there is not a great margin in favor of the high-pressure except that the pressure can be raised and capacity thereby increased. Then we must consider the fact that the high-pressure requires constant care and attention, not only for the compressors, but also for the regulators.

Looking at it as the bond-holder or stockholder would, I would rather have my money invested in cast-iron pipe. Assume the life of cast-iron pipe to be fifty years and its maintainance practically nothing. This would be preferable to reciprocating machinery such as compressors in conjunction with wrought-iron or steel pipe. The life of the pipe depends upon the reliability of the man who does the coating. The life of a compressor at highest efficiency is not more than fifteen years. As they must be overhauled at least once a year, there is a high maintenance cost. Carelessness on the part of the operator may badly damage or completely wreck a machine.

In these arguments favoring the ultimate economy of the low-pressure system the writer is not ignorant of the fact that high pressure has bridged over many financial difficulties for gas companies. But it is a toll bridge and not built of sufficiently durable material to stand heavy traffic.

The present tendency of political development in our states and cities is toward regulation of public-service corporations. Those who have watched the working of the public-service commission of New York must have observed the trend of events. There is little doubt that a similar commission will eventually exist in all the states. By the regulation of such a commission a corporation is allowed to earn interest on or issue securities covering actual investment only. Such rules will work against the system having cheaper first cost but higher operating expense. Under such conditions a low-pressure system would have its financial advantages.

Economy of operation: This whole subject might be summed up in the following expression:—

Know what your plant is doing at all times, and know the condition of your plant while doing it.

This is a rather inclusive statement and means first of all that a works should have a full equipment of apparatus for recording and making observations, beginning with the photometer and gas-analysis set and including all the ordinary indicating instruments, such as thermometers and U-gauges between scrubbers, at each side of exhauster, and other important points throughout the works, oil and steam nozzle gauges on generators, recording gauges in superintendent's office connected to each generator, etc. The writer has never seen a gas works with too many such devices installed. But these instruments are of no use unless properly cared for and kept in working order.

After this consideration of the equipment, then there remain the many odd little leaks, small individually, but having in the total a marked effect on the economy of the plant. There are the small leaks in steam lines, valve stems, or long runs of steam line to idle equipment with no main cut-out valve; leaky stuffing-box-glands on engines, compressors, pumps; quick-opening doors on scrubbers or yard connections which do not close tight. Holder-carriage rollers should be oiled and an inspection of holder cups made during the dry season to keep them filled and prevent blowing. This is a slight compensation to our Eastern brethren who have to prevent freezing in the winter time. Some plants shut down their boilers too often on account of poor water when a proper chemical treatment to suit the given condition or even filtration where sand or grit is present would effect an appreciable saving.

The possible economies in a gas works are as many and as varied as the parts that go into its making. They are limited only by the care and resourcefulness of the man in charge. This brings us to what is really the biggest and most important factor in the economy of a gas plant—the personal element.

Purchase of the Suburban Electric Light and Power Co.

The Pacific Gas and Electric Company has acquired, by purchase, the properties of the Suburban Electric Light and Power Company, and has taken possession of said properties as of January 1st, 1911, and will hereafter operate the same.

So much of the territory supplied by the said Company with gas and electricity, as lies within the corporate limits of the city of Oakland, will become a part of the Oakland Gas, Light and Heat Company, and all consumers will be billed by that company. The rates from and after January 1st, 1911, to be the same rates as prevail in said district of the Oakland Gas, Light and Heat Company.

All territory lying east and south of the eastern corporate limits of the city of Oakland, will be known as the Alameda County District of the Pacific Gas and Electric Company, and billing will be made accordingly. The rates now prevailing in said Alameda County District, and heretofore charged by the Suburban Electric Light and Power Company, will remain in force until further notice.

Mr. Frank A. Leach, Jr., will be the manager of said Alameda County District, with headquarters in Oakland.

The present method of branch offices, and the present force, both clerical and operating, will be continued until further notice.

Discipline as a Principle of Efficiency in Business

Abstracts from the original article by Harrington Emerson in the *Engineering Magazine*, New York-London. From *Ideal Power*, December, 1910.

DISCIPLINE is taken up as the fourth principle of efficiency in the successful conduct of business, by Mr. Harrington Emerson in the series of articles being published in the *Engineering Magazine* of New York and London, from which we extract as follows:

"Discipline as an efficiency principle includes all meanings, from lessons of life to man-inflicted punishment. The greatest regulator of conduct is the spirit of the organization.

"It is not incredibly short sighted to throw to the winds such mighty helps to discipline as the spirit of the plant, the general scheme of conduct, and to place reliance in the undisciplined acts of discipline of individuals clothed with a little brief authority?

"Because the success of the whole plant depends not on its wealth, or its men, or its product, but on its spirit and rule, penalties for persistent infraction should be relentlessly severe.

"If the spirit of the plant does not drive an undesirable associate away, if standard operation and standard practice, both of which affect conduct, if reliable, immediate and adequate records, if absence of efficiency reward do not automatically, effectually and peaceably eliminate the undesirable, it is time for the strong hand to descend.

"Under the best management there are scarcely any rules and there are fewer punishments. There are standard-practice instructions so that every one may know what his part in the game is, there is definite responsibility, there are reliable, immediate and adequate records of everything of importance, there are standardized conditions and there are efficiency rewards.

"There can be no organization without discipline, as in all plant life; there can be discipline without organization, as in most animal life. Because man has supernal ideals; because the progress of centuries can be lost in a year, in a minute, even (as during an earthquake) if organization is weakened—the devil indeed catching the hindmost; because our unstable human organizations, even the integrity of the family, depend on discipline, it becomes a fundamental efficiency principle which continuously, vigorously, never falteringly enforces a series of standards of high individual or combined conduct.

" 'He that ruleth his spirit is better than he who taketh a city.' Discipline is not arbitrary rules with punishment with shortcomings real or imaginary.

"Fine manifestations of disciplined performance are the four eighteen-hour trains each day between New York and Chicago. So unobtrusive is the perfect discipline that the passenger sees no rules or orders given, he does not see the far-ahead light or semaphore signals that govern progress, he sees still less the telegraphic messages flashed by the dispatchers to the signal towers, he knows little of the duplicate orders issued to conductor and engineer. The discipline is that of the velvet paw armed with the sharpest claws, infraction possibly resulting in destruction of the whole train, a trans-human punishment; infraction, even if there is no immediate disaster, resulting in reprimand or dismissal.

"So great is inefficiency of all kinds everywhere that the application of even this one principle of discipline has produced great results through military or church organizations. Just as soon as a community bends to discipline, whether its members are followers of

Romulus, of Leonidas, empires are either founded or shattered, and just a little discipline as to dress and work have made such American communities as the Shakers, Economites, Mennonites, wealthy. In the army as in the church the first vow is obedience; and in Schiller's ballad the slaying of the dragon did not save St. George from condemnation and punishment for his disobedience. The large office buildings in New York are peculiarly dependent on discipline. They are miniature cities in which all municipal activities, lighting, heating, cleaning, transportation, are constantly going on. As long as the tenants are present from 8 a. m. to 5 p. m. high order is maintained, but shortly after 5 o'clock discipline relaxes, attendants raise their voices, begin to smoke cigarettes, to romp, and the conviction grows that if these modern palaces were turned over as a possession to their own trained attendants, in an incredibly few weeks they would be marred and scarred, dirty and disorderly, physically and morally.

"Family life can exist in the gypsy caravan or in the Arab tent or Indian tepee, in the wolves' den or in the bird's nest, but we owe to the continuation of civilization to the citizen efficiency and standard-practice engineers, men and women, heads of great institutions, governments, corporations and enterprises, who design and erect the firm skeleton of discipline that maintains in place the units of individualism, lest the whole aggregation tumble to ruin at the first shock in earth or air.

"It is the spirit of discipline, not its letter, that counts, and the spirit is reciprocal from bottom to top, from top to bottom and sideways to all associates; it is reciprocal between the individual and the flag under which he is industrially enlisted.

"The time to inspect boiler sheets is before they are made up into steam boilers; the time to inspect anchor chains is in the making.

"In industrial life everything is tested, materials, design, except the all-important men. In the little shop, rigidity of human inspection is high, the master looks over each man, has probably watched him for months or years before engaging him; but in the large shop, where the personal inspection of master has become impossible, even the most elementary safeguards are thrown to the winds and men are absorbed with less discrimination than the furnace under the boiler absorbs air.

"No man enters West Point without passing severe elementary examinations. It is a tremendous privilege to be admitted, a disaster to be excluded. There ought to be a high membership ideal for every plant, no newcomer admitted who was not fit in every way, no man cut off except for cause. Discipline begins before the applicant is taken on. Nine-tenths of all the harder discipline ought to be applied to exclude undesirables, men who by reason of bad character, bad and offensive habits, destructive tendencies, laziness or other faults, are unfit to become working members of a high-class organization. It is before he is admitted that the applicant should hear of the ideals of the business, of its organization, of its methods.

"The principles of efficiency are not vague platitudes; they are intensely practical remedies, tested, tried out, and successful in preventing wastes, preventing the losses caused the state and community by the cessation of labor hundreds of thousands of men, preventing the greater misery and suffering due to the enforced idleness of heads of families. While master and man quarrel and bicker, the state suffers and women and children pay the penalty. Socialism gains recruits not from the arguments of its advocates, since no human being is naturally a socialist, but from the unendurable shortsightedness and shorter temper of individualistic men.

"It is not enough for the owners to have ideals; they must be transmitted to the employee, and nothing is easier, as any one who has studied the psychology of crowds knows; but it is idle to expect the average worker to

rise above the spirit of the place he works in. If it is untidy, disorderly, filthy, if the accommodations for his necessities are lacking or vile—imposing steel and concrete construction, compound condensing engines, and all the over-equipment to which in the past we have pinned our faith, will not inspire the worker.

"The self-executing discipline that is worthy to be an efficiency principle is the allegience to and observance of all the eleven principles, so that the twelve principles do not become twelve rules unrelated to each other; they do not become separate and easily dislodged rails of a fence, which is more an indication of boundary than a barrier.

"The twelve principles of efficiency are the strands of a net, each interwoven with the other so that in reality the first study of any organization is to find out to what extent common-sense, competent counsel, discipline, and the other eight principles have been applied to the first principle 'Ideals.'

"No efficiency principle stands alone, each supports and strengthens all the rest, each is supported and strengthened by the other eleven. They are not as mutually interdependent as the stones of an arch, each a key-stone which if removed brings about the collapse of all the others; they are more like the stones of a dome, any one of which can be taken out, leaving a weakened, but not a destroyed structure."

When "Wallace" Called Them Up

There was merriment in Gasville
  The day the biters bit,
At the 'phone call left by "Wallace,"
  Listen while I tell of it.

First Burdick got a little note:
  "Mr. Wallace left a call,"
He rang up West 6140,
  Ah! heavy did he fall.

"This is Burdick of the Gashouse:"
  Said he in anxious tone,
"Mr. Wallace wants to talk to me,
  Tell him I'm on the 'phone.

"There 's no such party at this place"
  Came back the quick reply,
But Burdick, angry, said there was,
  And the fur began to fly.

"Wallace wanted me to ring him up;"
  The whiskered Burdick said,
"Go chase yourself," the man replied,
  "You 've got wheels in your head.

Then Bonamy his ledger dropped,
  He took a great big bite,
When told there was no Wallace there,
  Said: "Never mind, I 'll write."

Next Simpson got the word to 'phone,
  But the man had got a "hunch,"
Said he, "Wallace is not here just now,
  He 's busy taking lunch."

"How long will he be gone away?"
  Said Simpson, looking sour,
The answer came, "I 'm not quite sure,
  But he feeds about an hour."

Then Simpson said, "All right, old chap,
  This is Sutter 140,
Just tell him he can ring me up,
  I guess I 'll have to go."

The biting bunch just grew and grew
  As one by one they fall,
There 's Whiting, Boggs, and others too,
  Swallowed bait and hook and all.

The last to bite was Kuechen—
  He wished to be alone
So we couldn't overhear his talk
  He went downstairs to 'phone.

"Call Mr. Wallace to the 'phone,"
  Said Kuechen, "for they say
His business is most urgent,
  So I called up right away."

Said the "Guinea" on the other end,
  Whose patience they 'd been trying',
"Say you, come off, this is the *Chutes*
  And *Wallace is a lion.*

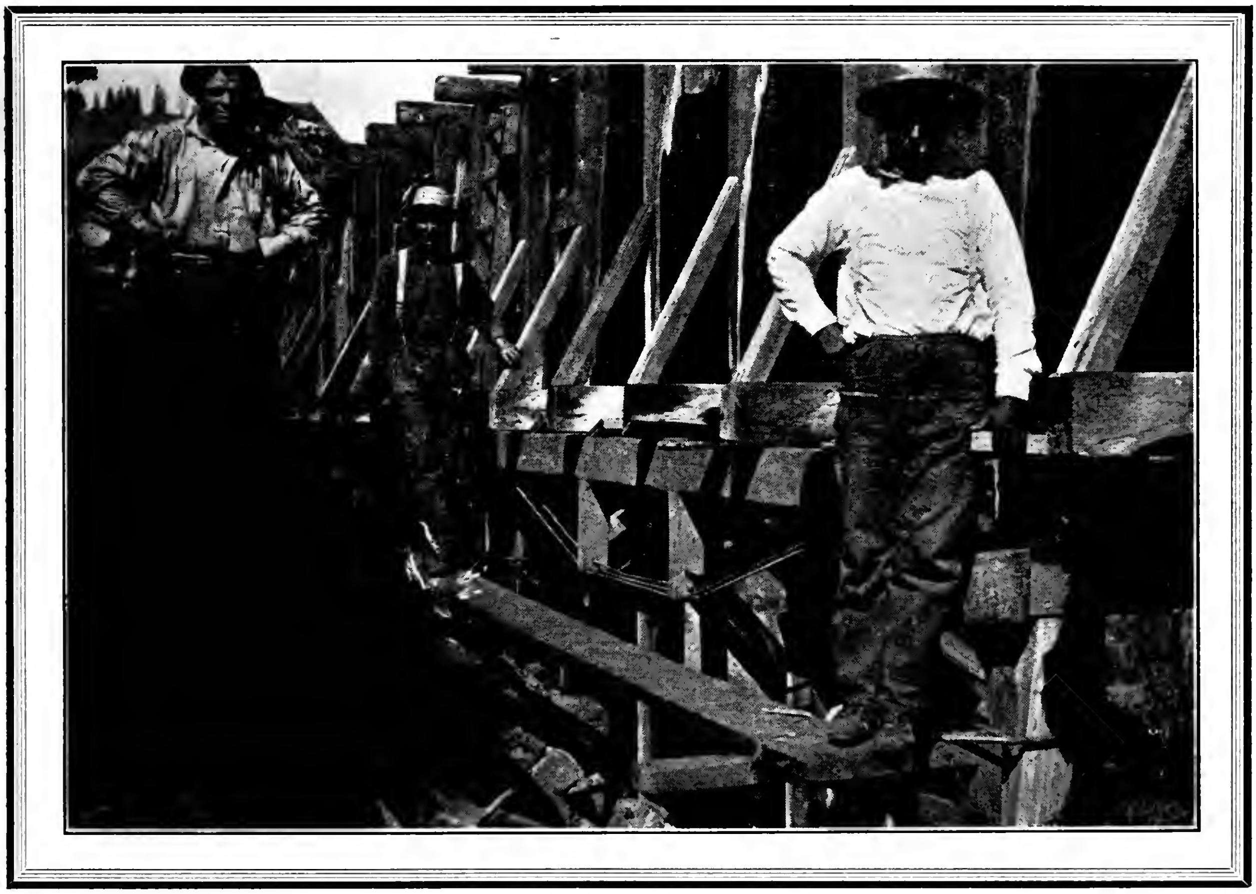
EUGENE A. BEAUCE,
Bookkeeping Department.

A Time-Saver in Flume-Repair Work

By ALFRED E. GILBERT, Colgate Power Plant.

IN his experience of many years as foreman of the Colgate flume C. L. Royat has devised many ingenious things in the work of repairing that structure.

The Colgate flume is nearly eight miles long. It is seven feet wide and five feet deep. It carries a constant flow of between 9,000 and 12,000 miner's inches of water, which is a great deal more water than flows into San Francisco for the city's total uses. Such a volume of water weighs an enormous amount. The flume structure must be strong to hold up under that weight. Repairs must be made without interrupting the flow on its way down to the forebay, high above the big electric power plant at Colgate.



One of the tricks of this business of keeping the flume in repair is to remove and replace decayed and broken timbers.

The photographic illustration shows C. L. Royat himself in the foreground at the right. Between him and the man further back along the flume is a false stringer which he has invented and successfully used. By inserting this stringer the work of repair may be so hurried that three men using this device can repair two or three more stringers a day than by the old method.

To repair a stringer by the old method it is first necessary to put in false work to support the flume while repairing is in progress. This false work would consist of six-by-

eight-inch timbering sixteen feet long supported in the middle by a false post of the same size stuff, only varying from one foot to twenty feet in length. Then wedges would be used to raise the sills and take the weight off the timber to be replaced.

But with the false stringer no supporting post is needed. The stringer carries the weight without any support whatever.

The false stringer is made from a five-by-seven-inch timber sixteen feet in length, supported by two five-eighths-inch steel rods, braced with two short central posts held in place by a rod of half-inch iron.

The whole thing weighs but one hundred and eighty-five pounds, and is easy to move.

Concrete Poles for Transmission Line

From *Engineering Record*, May 21, 1910, p. 668.

The present 30-mile 30,000-volt transmission line of the Marseilles Land and Water Co., Marseilles, Illinois, was built in 1907, using concrete poles with some of wood for comparison. During the three years that the line has been in operation, the concrete poles have given most satisfactory service. In a number of instances lightning has shattered the timber poles, while but one concrete pole was struck. In this case, the only damage was to chip a small piece of concrete out at the top and another at the bottom of the pole. During the time that the line has been in operation, numerous other poles have been wrecked by sleet and ice storms, but this line has stood without a single instance of damage from this cause.

The standard spacing is 125 ft. on one branch and 132 on another. The standard pole is 30 ft. long and 9 ins. square at the base. All poles are 6 ins. square at the top and up to 50 ft. long have the same taper. Above that length the taper is changed slightly to secure a heavier section

Electric Company's Instructive Display

Miniature Aeroplane Made by George Scarfe Also on Exhibition

From *Daily Transcript*, Wednesday, Jan. 11.

In the windows of the Pacific Gas and Electric Company on Broad Street, Nevada City, there is an interesting and instructive display, which many people have viewed and which has attracted a great deal of attention.

In the upper window is an electric meter with the covering removed, showing the mechanism and how one works. There are six lights connected with the meter, and a switch is arranged, so that three may be turned off. When the six lights are burning the mechanism in the meter runs at a fair rate of speed, when three are used it goes considerably slower, while when only one light burns the wheels barely turn.

There is also a small aeroplane in the upper window. It was made by George Scarfe, division superintendent of the Pacific Gas and Electric Company, and is patterned after the Bleriot machine, which was the first to fly over the English Channel successfully. A Bleriot aeroplane is now being used by James Radley at the aviation meet at San Francisco. The model made by Mr. Scarfe is on the scale of one inch to a foot. It is carefully constructed and shows excellent workmanship. Power is obtained from twisted rubber bands, and the little machine will rise into the air when set in motion.

The lower window of the offiice is neatly arranged with gas fixtures of various kinds. In the front there is a gas meter, having glass front and top in order that people may ascertain how the inside of one is constructed and the effect the use of gas has on it. The display is a novel one and has attracted much attention, nearly everyone who passes the office stopping and looking at it.

How To Manage a Public Utility

As Explained by a Chicago Man of Wide Interests

SOME of us learn things by actual experience. But very few of us get a chance at the experiences that fit for big positions. So, when a successful man tells us how he did it, we not only get the benefit of his experience, but the tip saves us a whole lot of time.

There is not time in life for any one man to learn all things or several great things by actually trying them. Many experiment. The wise few know how to adapt what has been proven effective. Success consists largely in avoiding the errors that have proven disastrous to others. To know where to get your information is half the problem solved.

In Chicago there is a man named Arthur S. Huey. His business is managing public-service corporations. He is not yet fifty. Before he was thirty he used to be connected with the sales department of the General Electric Company. Now he is president of the Ottumwa Street Railway Company, of the Fort Smith Light and Traction Company, of the El Reno Electric and Gas Company, of the Consumers' Power Company of Stillwater, Minn.; and vice-president of the Oklahoma Gas and Electric Company, of the Muskogee Gas and Electric Company, of the San Diego Consolidated Gas and Electric Company, of the Mobile Electric Company, and of the Enid Electric Company.

So much for the scope of his business management. Now for what he has to tell. Recently he wrote for "Public Service" an article on successful utility management. Some of the more significant things are here reprinted:

Fairness is inherent in the American people. In the long run justice prevails. The public utility man who has done his work well—who has responded to the special demands of his opportunity—will not be unjustly dealt with.

There are few occupations demanding higher qualities of ability than the management of gas, electric, and street-railway properties.

There are few occupations more thickly strewn with complicated problems; more cluttered with exacting detail, and demanding a broader vision, better judgment, and the insight of a true executive.

It has become more and more difficult to find men of the many-sided ability and suitable temperament necessary to manage utility properties successfully. The necessary qualities of a good utility manager seem to be monopolized by a limited number of individuals.

Success in conducting utilities today does not mean merely the earning of good dividends one year and perhaps the next year. It includes earning these dividends with the approval and satisfaction of the community served.

The old order of things has passed away. A new era in public utilities is in vogue, and public utility men must conform to the new conditions or get out of the business.

The keynote of the modern situation is embodied in the fact that utilities must return full value for every dollar of revenue received.

Regardless of franchise rights or any other artificial protective barrier, it is up to us to deliver the goods or someone else will be delivering the goods in our stead.

Men in charge of utilities who can rise to meet the new demands and solve the problems imposed will be rewarded as they deserve.

They will derive substantial compensation for their ability and energy, and they will receive the admiration and respect of the public. They will, in a few years, come into their own and will receive such honors and emoluments as may be reasonably expected in commercial life.

From a plain commercial standpoint the importance of treating the public properly can not be emphasized too strongly.

The time arrived several years ago when the relations of operating companies to the public called for very intelligent and careful treatment.

Since then there has been an extraordinary change in a public-service corporation's conception of its obligations to its consumers.

The companies which have become most considerate and liberal in their interpretation of the public's rights have become the most profitable and stable.

Managers should devote continual study to the relations between their companies and the public. They should understand the real meaning of franchise rights, and should be thoroughly familiar with both their moral and legal obligations.

The last ten years has witnessed widespread agitation and discussion of the question of public relations of the utility business. New theories and practices have been developed and tried out. Some of them have proved extremely profitable to corporations and to the public alike. Others are bad for one or the other, or both. Some are in the experimental stage.

All of these questions should be given the closest possible attention by the manager. He should be able to meet the inquiries and arguments of newspapers, politicians, and citizens. His answers must be logical and plausible.

It is foolish to permit criticism of a company and its methods to go unchecked. The ostrich, with its head in the sand, is a good deal like the utility company which ignores everything said about it and refuses to avail itself of the various means of defense accessible to every individual and every corporation.

Every knock against the company which goes unanswered is accepted by some one as being justified. Our defense can often be accomplished without expense, simply by being frank and decent to a newspaper reporter, or taking the time to talk matters over with a leader of opinion who does not know the facts.

If I had the time I might tell an interesting story concerning the transformation of a militant socialistic agitator from an enemy into a friend of one of our companies within the past year. This man was one of considerable talent and power as a public speaker. He started to hammer the company unmercifully in public addresses. An hour's interview in close proximity to the books, reports, and records of the company convinced this opponent that he had made a mistake.

The utmost tact and courtesy must be employed in meeting the public. Our forces should be so organized that the men who come into most frequent contact with the people are fitted by training and temperament to settle grievances so as to leave a good impression and to obliterate prejudice against the company.

The public judges the corporation largely by its representatives.

The financial houses and the investors were among the first to recognize that monoplistic rights may be just as easily a weakness as a source of strength.

There was never yet a monopoly which could not be broken, and the bigger the monopoly, the greater was the ruin when destruction took place.

Monopoly means the concentration of responsibility. If a monopolistic company fails to give good service at reasonable prices there is no way of evading the blame. We have to stand for it, and the public can punish us very easily.

Conditions which permit competing utility companies are becoming fewer, though municipal ownership and operation is possible in most cities. Regulations controlling corporations are more widely existent than ever before. Franchises are usually for short terms, requiring frequent renewals, and in many states every new franchise must go before the people for a popular election.

The capitalist knows that a utility company must stand well in the estimation of a majority of citizens if it is to be prosperous and permanent.

Therefore, he has shown a strong tendency to insist that the company in which he invests shall be on good terms with the people; shall be progressive, honest, and give adequate service at rates no higher than are fair.

The financier realizes better than many of us, I think, that a company possessing the confidence and good will of the public always does a far larger business than the company which is "in bad" with the public, other important considerations being equal.

We look to what a man does rather than to his explanation of what should be done.

Managers can help both the plants and the cities to grow more rapidly if they get on the job right and stay on it right.

Staying on the job right is a much harder proposition than whipping things into shape

and organizing and systematizing a property that has been neglected.

It is by working out our ambitions despite any and all conditions that we demonstrate our fitness and worth.

It 's doing your best with the tools you have, rather than waiting for what you ought to have, that puts a premium on genuine ability.

The commercial side of public utilities is their first essential. Remove the element of profit and all development and progress would come to an abrupt standstill.

The ideal manager of a utility property is the ideal executive.

It is far more important that he be a good man of business—in the best meaning of the term—than that he be a good engineer or an engineer at all.

Universities are turning out hundreds of engineers every year. Not more than one true executive is born each month, is the opinion of those who have tried to find them.

The commercial exigencies of utility organizations fall upon the manager. He must see that operation is profitable. That is the principal purpose for which he is employed.

The only way a utility property can be made legitimately and lastingly profitable is by pleasing the public. Dealing properly with the public has become the manager's most difficult problem.

The ideal utility manager should be a man who understands the public better than the best politician in his city; a man who is versed in practical modern sociology, and who understands, not only big financial matters and has large business ideas, but understands the lives and character of his people.

An Historic Building of Stockton

THE old residence of Captain C. M. Weber is to Stockton what Sutter's fort is to the city of Sacramento. They were built about the same time in the early days of California. But the Weber mansion has not received the public or the local notice that its traditions deserve.

Windowless, an artistic ruin, in an overgrown weed patch, shaded by old trees, and surrounded by a dilapidated fence, the old place shows its age and proclaims its neglect.

Captain C. M. Weber was the founder of Stockton. He was there as early as 1844. He owned an immense tract of land in that district. At that time and for several years afterward the locality was known as Tuleburg, or as Weberville, or as Castoria. But there were no babies there then crying for Castoria. The place was crying for settlers, and could get none, although Captain Weber was regularly offering a square mile of land to any American immigrant who happened along.

In those early years the raising of cattle for their hides and of horses for their use were the principal California industries. The loneliness of the tule country blinded the judgment of those early comers who saw nothing alluring in the evident productiveness of the soil or in its vast expanse, the million of acres, that in the springtime made of the San Joaquin valley a velvety carpet of the most wonderful floral loveliness.

It was not until 1848 that Captain Weber succeeded in inducing settlers to locate, and then Tuleburg had fifteen or twenty of them. In those days the nearest neighbors were Sutter's Fort on the north and San Jose on the south.

But within twenty months after the first discovery of gold in California, Tuleburg had become Stockton, with a population of two

thousand men. So thick and fast came the vessels from San Francisco with miners that the channel was completely crowded with sail-craft. Some of the ships were used as lodginghouses, others as storehouses.

At that time eggs were $12 a dozen, and they were not hens' eggs either, but sea-birds-eggs from the Farralone Islands. Cowhide boots were $50 a pair, and blankets were sold at from $75 to $100 a pair. Meat was the only commodity of comparative cheapness; it sold at twenty-five cents a pound. The butcher took a rifle and a sheath knife and rode out on to the plains, and then came back to town dragging the quarters of beef over the ground at the end of a riata.

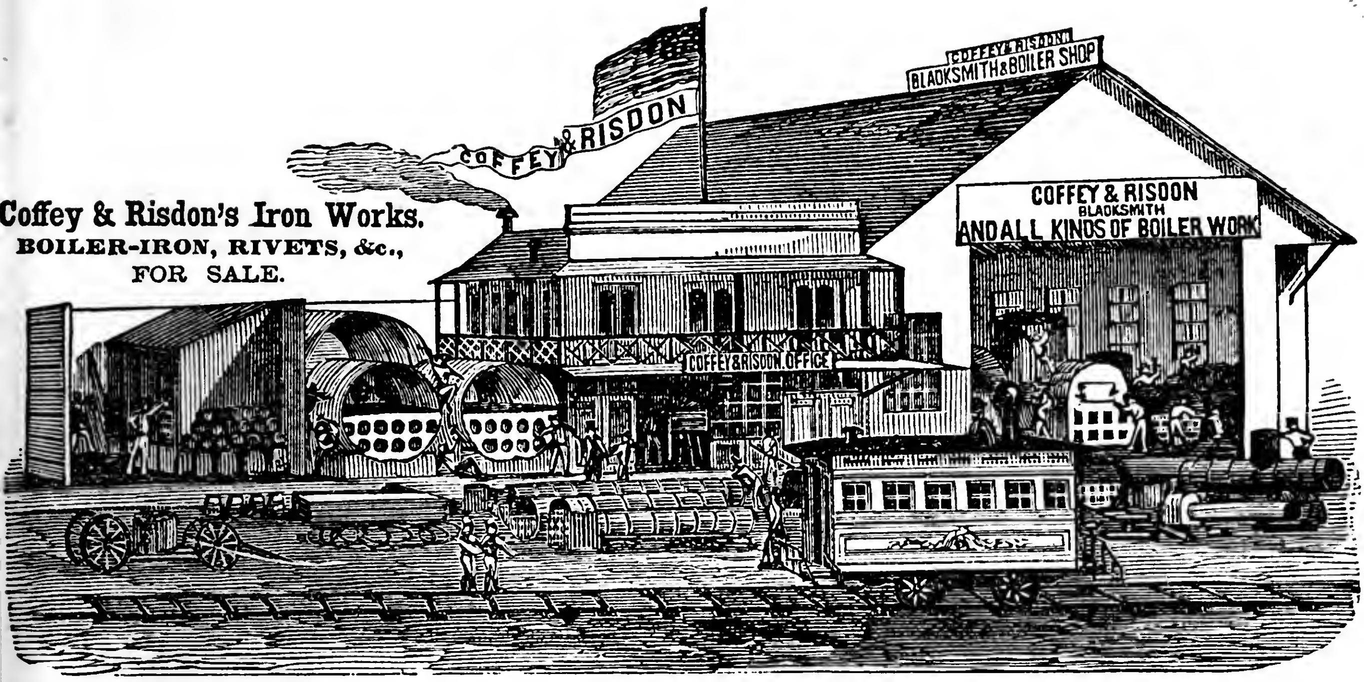
Within seven months there were seven little steamboats regularly plying between Stockton and San Francisco, and the passenger fare was eight dollars. One of these boats made a net profit of $120,000 in eight months.

Captain Weber had erected on the south bank of the channel the first store building in Stockton. During the early excitement some of the merchants repeatedly offered him thousands of dollars for fifty-foot lots on the waterfront, but he steadfastly refused, declaring that he intended to preserve the waterfront for the use of the general public.

The old Weber mansion stands close to the steamboat landing, on the little peninsula that separates the two branches of the Stockton channel. The first brick chimney in Stockton was that constructed in the Weber house, and the bricks came round the horn and were bought by Captain Weber at one dollar each.

Old Weber Home, Stockton, Cal.

Professor Alfred H. White of the University of Michigan is conducting a series of experiments in the manufacture of gas. To aid him in his investigations he has had installed recently a special meter, designed and built for him by V. P. Wilkins, general superintendent of the La Porte Gas Meter Company.



The Risdon Iron Works in 1862.

The Risdon Iron and Locomotive Works

IN 1862 Coffey & Risdon built a blacksmith and boiler shop at the corner of Market and Beale Streets, San Francisco, on the site afterward occupied by Holbrook, Merrill & Stetson. Six years later the business had developed to the point where new capital and organization were needed, so a new company was formed, under the name of the Risdon Iron and Locomotive Works, which is today the corporate name, and an entirely new plant created at Beale and Howard Streets.

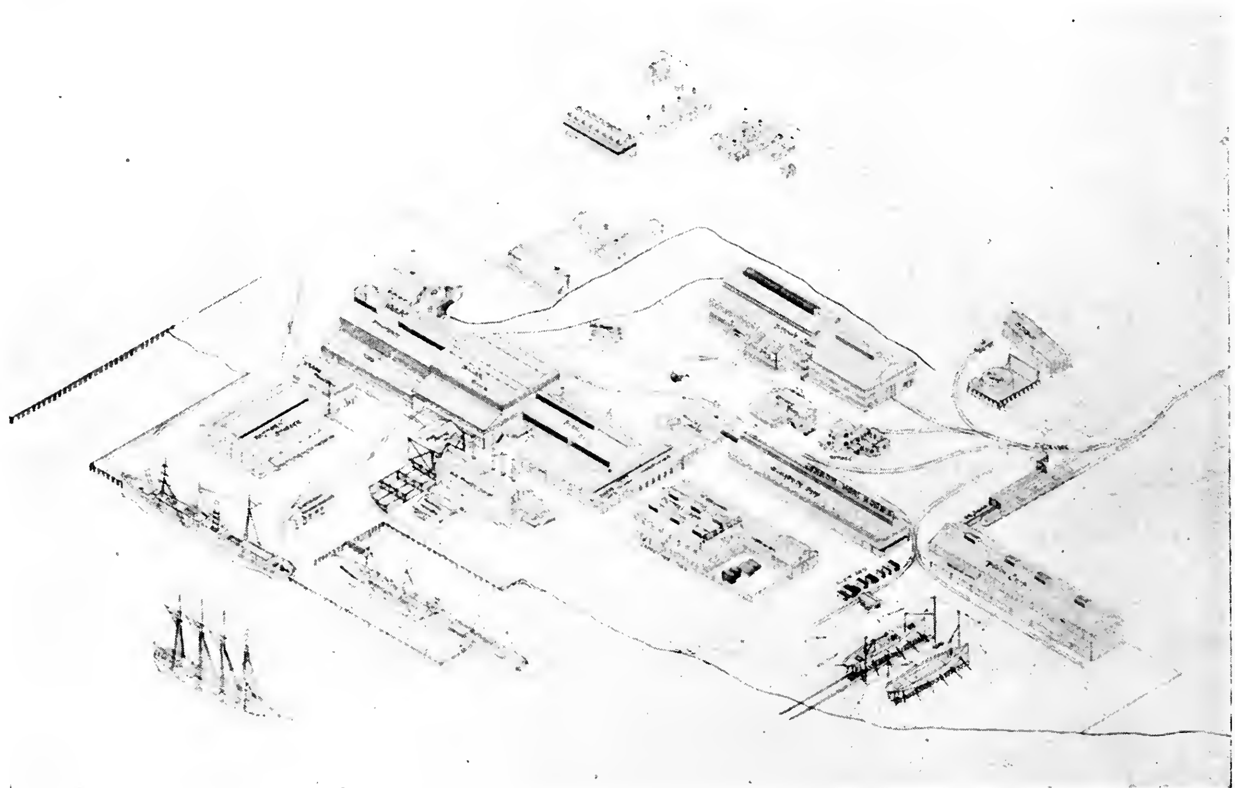
For over thirty years the Works remained at this location, growing by the remodeling or addition of building after building, and turning out machinery and structural shapes of many kinds.

Then the need of more room, and of spur-track, waterfront and other facilities caused the Works to be removed in 1901 to the present location in the Potrero, at Twentieth and Louisiana Streets, fronting on San Francisco Bay. Some notable work had been turned out from the Howard Street Works; as for instance, the steel for the San Francisco Ferry Building of the State Harbor Commissioners, and the structural steel and iron of the gigantic Spreckels sugar refinery in Monterey County, California; numerous Corliss pumping engine units were shipped to the sugar plantations in the Hawaiian Islands.

At the new location a period of great activity was entered upon. It would be hard to name a line of mechanical construction or repair work which has not been successfully undertaken. There are now being made, for example, water-tube steam boilers, engines, pumps, supply and repair parts of every description; marine structures, from the smallest bolt up to the complete ship; hydraulic pipes and machinery; highly specialized machinery, such as gold dredges; and the list might be continued in almost endless detail.

This works was one of the first industrial plants on the Pacific Coast to install motor drive using alternating current induction motors. For a time, at the Howard Street plant, electric energy was generated on the premises by steam engines, but as soon as the limitations of this method in a growing plant were realized the power was bought from the central station supply.

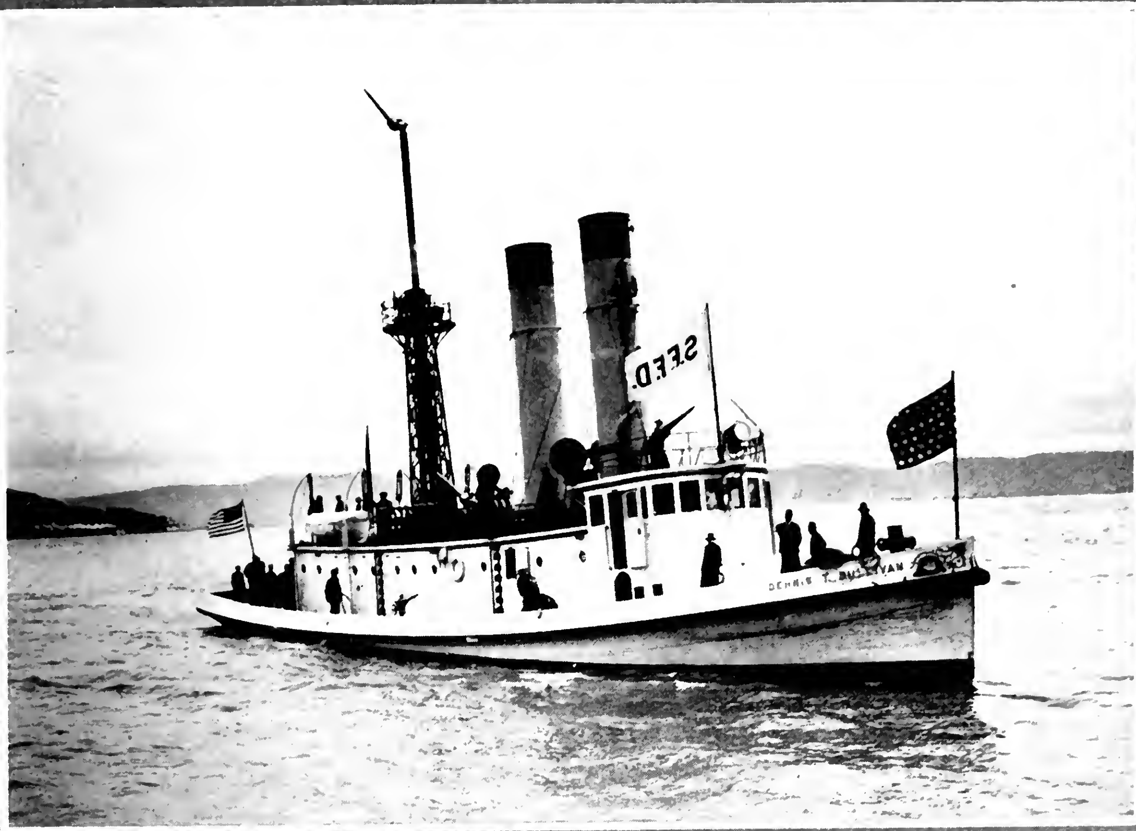
In the ten or twelve years just passed, only three interruptions to the electric power supply

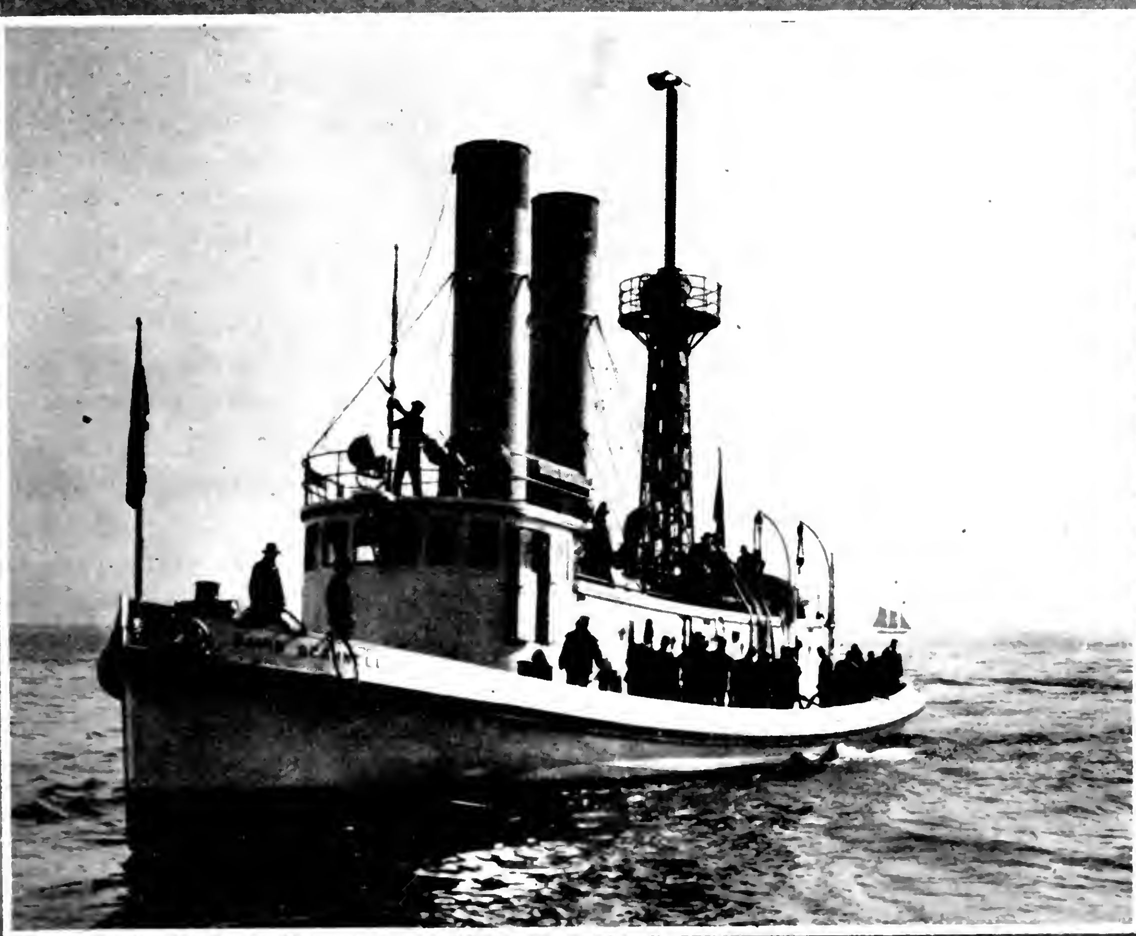


Bird's-eye view of the Risdon Iron Works.

are known to have taken place. One was occasioned by the breaking of some insulators on the roof of the building and was repaired in a few minutes. Another was caused by a fire in a near-by street, at which time some wires were cut down; this shut-down lasted less than half an hour. The third was of such short duration that no record was made of the time it took place, so that it cannot now be identified.

An electrically operated gold dredge at work





THE FIRE BOATS "DENNIS T. SULLIVAN" AND "DAVID SCANNELL"
BUILT FOR SAN FRANCISCO FIRE DEPT. BY THE RISDON IRON WORKS.

Shipyards of the Risdon Iron W

When the new works was built at the Potrero, arrangement was made for the purchase of the entire supply of energy from the lines of the Power Company, except that it was necessary, of course, to operate the large hammers in the blacksmith shop by steam; and it was also deemed advisable to use a steam-driven air compressor made at the works. The varied uses to which the individual motors which make up the eighteen hundred horsepower are put to can only be touched on briefly; mention should be made also of the one hundred and fifty arc lights and over twenty-five hundred incandescent lights installed at various points on the thirty-three acres of yards and buildings.

In the draughting room, where plans and drawings are prepared, an electric blue printing machine obviates delays in that process. The pattern and carpenter shops use both individual and group drive for their various machines. In the blacksmith shop, an electric crane handles the blooms and forgings. This department contains what is believed to be the largest steam hammer in use on the Pacific Coast; it delivers a striking blow of five tons. The machine shop contains over two hundred and fifty horsepower, the principal motors being four of fifty horsepower each driving line shafts, the remainder being in smaller motors for special purposes.

The shipyard has the usual equipment of punches, rolls, shears, plate-planers and presses; the shear legs on the dock is equipped with two induction-motor-driven hoists, having a combined working capacity of one hundred tons lift, and an emergency rating of one hundred and fifty tons.

Here were built the fireboats "David Scannell" and "Dennis J. Sullivan" for the San Francisco fire department. These sister ships are of steel, 129 feet long over all, 26 feet beam, with a depth of 12 feet 9 inches. The engines, two for each boat, are reciprocating, while the pumps are multi-stage turbines driven by steam turbines. There are two sets of pumps on each boat, arranged so that both sets may work at 150 pounds pressure into the discharge line, or the sets may be connected in tandem to deliver 300 pounds discharge pressure with but half the volume. Each ship is equipped with monitors

owing Vessels Undergoing Repairs

and water-tower on top of the deck house; and at other points with monitors and multiple hydrant connections.

The pipe-making shop manufactures hydraulic pipe to any commercial specification. A brass foundry, coppersmith shop and tinsmith shop each find their quota of work; and use electric power for shears, punches and like uses.

The substation building contains three banks of transformers connected to the 11,000-volt three-phase supply; one bank supplies the 440-volt two-phase motor lines; another distributes 110-220 volts for lighting; the third is part of a rotary converter equipment supplying direct current to the crane motor circuits.

In this building is located the motor-driven hydraulic pumps which supply the presses, punches, and similar machinery at the shipyards. A working pressure of fifteen hundred pounds to the square inch is maintained in the hydraulic system. Here also are the steam boilers and the steam-driven air compressor.

It is interesting to note that the electrical department, by an ingenious equipment of flexible cables and interchangeable parts, can put in operation, in less than an hour, on board a ship visiting the works, one hundred lights or clusters of lights for work after dark. The current is, of course, supplied from shore. Sometimes the ship's own lighting circuits and fixtures are available, and only the current need be supplied; in this case alternating current of whatever voltage is required by that particular ship can be immediately supplied from a multi-tap auto-transformer.

The Risdon Works are the pioneers in building successful gold dredges in this country; this industry has grown to be so important that a special corps of men in each department devotes its time exclusively to dredges and mining work.

The Risdon Iron and Locomotive Works are especially noteworthy from their early and continued use of electric power, and to Californians, from the fact that they are a locally financed and operated concern, whose growth and fortunes have been closely identified with the growth of San Francisco and the whole State.

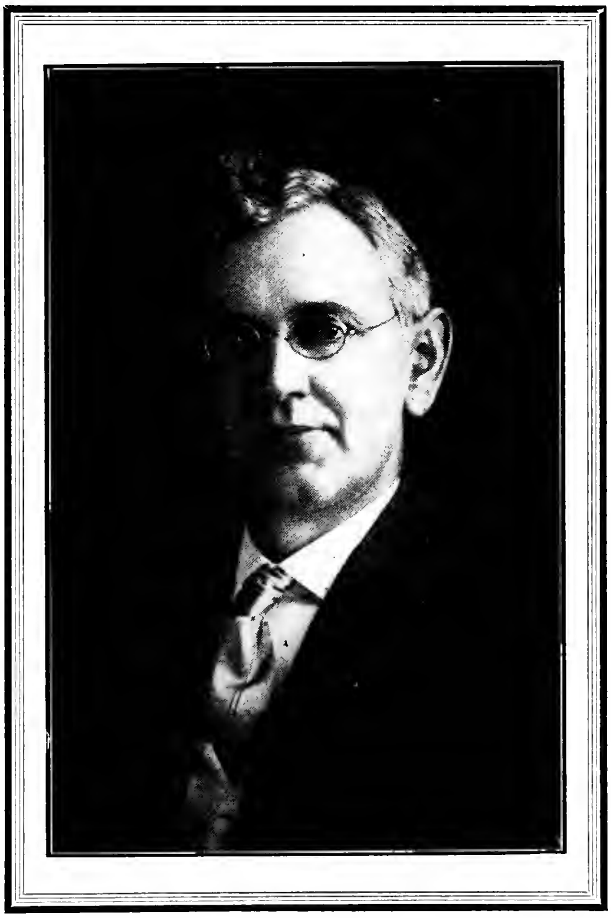
F. J. S.

MEN OF THE COMPANY

JOHN WERRY

Prominent in the Mining and Political History of Nevada County and Manager of the local Gas and Electric Company of Nevada City and Grass Valley for 18 years

ELLA WHEELER WILCOX wrote a truism when she said, "Laugh and the world laughs with you, weep and you weep alone," for the world loves a man who laughs, and can smile even in adversity, and has no patience with the tearful one. The man who can greet his neighbor with a smile and a hearty hand-shake, can make his way successfully through more adversity than the one who is always looking from the viewpoint of a pessimist, rather than an optimist.


John Werry.

Of all the men of the company, the subject of this sketch is one who knows how to smile, and has been doing it for the last fifty-eight years, which is a number of years on this mundane sphere, which honest John Werry acknowledges. It is conceivable that when he was ushered into this world, his first effort was that of a smile at the pleasure of being here, and he has maintained that smile consistently.

It appears from his biography that he was born September 5th, 1852, in good old England, but the lure of the "Land of the Free, and the Home of the Brave" brought him to America when he was eighteen years of age, landing somewhere in Pennsylvania, the place and time being unimportant. He soon tired of the effete East, and no doubt the attraction of the golden nuggets of Nevada County in California brought him to the picturesque town of Grass Valley, where he arrived in September, 1875. He filled, as men in the early days of California always did, various positions of usefulness, among others that of engineer and millman at the Idaho Mine.

Have you ever noticed the excellent chirography of John Werry? Old Spencer himself is not in it with the curves, shadings, and the mathmetical correctness of each letter of Werry's. This excellent mastery of handwriting naturally standing him in good stead, he drifted into clerical positions, political and otherwise, and was quite a busy young man in the several kinds of work allotted to him.

Full of natural energy and determination to succeed, he bears a record of never having been without employment from the time that he first sought it. He has been County Recorder of Nevada County, serving in that position with distinguished honor and unquestioned integrity, holding that position for ten years, and could have been holding it even until today did he not elect to ally himself with the Lighting Company in 1902, when he was appointed local manager of the Nevada County Gas and Electric Company, financed by Mr. John Martin, and has remained in that position up to the present time.

John is somewhat of a "jiner," and if he were to pin upon his manly bosom all of the badges representing the organizations of which he is a member, the texture of the cloth would be impossible to determine. This in a degree is popularity, and yet again is in a way a mark of esteem of his fellow-associates.

John Werry enjoys the friendship and the esteem of every man, woman, and child in Nevada County. His has ever been a helping hand; one of those dependable chaps that others naturally come to for comfort and relief. He is as sturdy in his friendships as are the mountain pines of the rock-ribbed hills of his chosen part of our glorious State.

Happily married to a helpmeet who in reality has been one, and a father of four children, he stands as a man of credit to his country, and one that we all sincerely wish was more often duplicated.

Telephone Manners

This is one of a series of advertisements appearing in the New York papers under the name of the New York Telephone Co. in an effort to instill courtesy into its subscribers:

"Would you rush into an office or up to the door of a residence and blurt out: 'Hello! Hello! Who am I talking to?' and then, when you receive a reply, follow up your wild, discourteous salutation with, 'I don't want you; get out of my way; I want to talk to Mr. Jones.' *Would you?*"

Few of the facilities of modern life are of greater convenience, greater *value*, to the commercial world than the telephone. It is not perfect, we must grant, like other things. We do not always get the unmber we ask for, and sometimes are irritatingly delayed in getting the right connection. It is not pleasant to sit with a receiver to the ear, even for a few minutes. The intermittent buzzes and raucous rattles jar one's nerves, so when we do finally get the connection, we may not be in a mood for the amenities of telephony, important as they unquestionably are.

Furthermore, when we do not get the desired connection promptly and properly, we usually have a suspicion—born, alas, of experience,—that Central has not done her whole duty in the premises. Central, like the telephone, is not perfect. Nor is it reasonable to expect her to be, any more than it is reasonable to expect the subscribers to be. *She* has *all day long* the annoyances that trouble us only occasionally. But after all, we ought to try to realize that it is really the person at the other end of the wire we are addressing—not just the instrument or exchange. If we do that we will hesitate to indulge in forms of speech that we never use when talking with people face to face. However grouchy we may feel, it is well to keep sweet in the use of the telephone.

Pacific Gas and Electric Magazine

PUBLISHED IN THE INTEREST OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - - - - EDITOR
A. F. HOCKENBEAMER - - - BUSINESS MANAGER

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The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. II JANUARY, 1911 No. 8

EDITORIAL

THE RELATIONSHIP BETWEEN CAPITAL AND LABOR is assuming, of late, a much saner and safer tone.

The life of Labor Organizations, as affecting Public Service Corporations, has been less than a decade. In that time the aggressiveness of Labor Organizations has been more pronounced than was the aggressiveness of capital that made necessary, apparently, the combination of Labor for its own protection.

Made bold by continued successes in securing a larger scale of wage, and shorter hours of labor, and being dominated by a spirit partially of reprisal, the Labor Organizations have sought, from time to time, to compel employers to agree to conditions of employment, and regulation of men, that have led to the many disastrous strikes which have occurred in recent years, but the day of reason is now dawning.

The controlling influences of Labor Organizations realize that continued unreasonable demands must enevitably lead to their being deprived in a large degree of lucrative employment. This has brought to the Councils of Labor a more temperate consideration of the rights of Capital. It is not difficult today to reason with the leaders of Labor Organizations, as they are beginning to feel that a mutuality of interest is for the common good. Capital, on the other hand, has begun to recognize the rights of Labor, and the necessity for such rules governing it as will promote harmonious feelings between employer and employed.

In the growth and development of industrial enterprises, and particularly in the work of Public Service Corporations, certain classes of labor are compelled to face more hazardous employment than formerly. The increase in the world's civilization has brought about the necessity for better living. The temper of the times calls for enjoyment of more pleasure in life than was accorded a few years ago. The opening up of public parks, the means of rapid transit to bring the country into closer touch with the city; the development of the cheaper methods of amusement, by means of the well-known nickelodeons and vaudeville entertainments, all while offering means of recreation for the tired worker and his family, are also productive of greater expense to him. The cost of living has unquestionably increased, so that what a few years ago seemed a reasonable wage, would today be insufficient for the majority of men.

There is, therefore, an apparent justification in reasonable demands of the mechanic and laborer, and these demands are now being reasonably met with when the employee shows a disposition to give of his best to the employer, and becomes appreciative of the advantages gained by his added compensation.

Inevitably Capital and Labor must work hand in hand, and not in keen opposition, and as a unit in organization, Labor is realizing that the employer, instead of being a hydra-headed monster, having a desire only to crush the ambitions of those employed by him, is but one of their own kind, and being of blood and bones, desires equally a living, both for himself and those associated with him on a higher plane of existence, so that the day's work may be accomplished without friction

and with satisfaction to both parties; an agreement that would mean, eventually, the betterment, not only of the men, but of the Nation of which they are an integral part.

Gas and Electric Extensions

From the *San Rafael Journal*, January 5, 1911.

The Pacific Gas and Electric Company has perhaps accomplished as much in this line as any one concern . During the past twelve months gas service has been installed through San Anselmo, Ross, and Kentfield. High-pressure mains have been laid through these towns, capable of caring for a far greater volume of business than exists at present.

In San Rafael the company has laid a six-inch main on B street, from Fourth to Second. A four-inch main on B Street from Second to Bay View and D streets. Six-inch main on Petaluma Avenue, from Fourth to Fifth. A four-inch main on Fifth Avenue from Petaluma to Grand, and a six-inch main on Fourth Street.

The original gas plant of the company in San Rafael was a gasoline affair, supplying but a few houses in close proximity to the works. The gas-holder was three feet high and three feet in diameter.

A large concrete bulding has been completed for the electric substation on Second Street; the purifiers have all been replaced by new ones, a new generating set and a station meter have been installed. One of the old buildings has been torn down and plans have been consummated for the razing of two others and the erection of two steel frame, fireproof structures.

The capacity of the electric line from Alto to Sausalito has been increased, and several sections have been rebuilt throughout San Rafael, San Anselmo, Sausalito, and Mill Valley, and preparations have just been completed for a new circuit to supply Ross and Kentfield.

Telephoning from a Moving Train

Wireless telephoning from a moving train was accomplished recently for the first time with complete success, on a stretch of railway four miles in length, near London, England.

Mr. Henry von Kramer, the inventor, who conducted the experiment, is an electrical engineer, trained at Munich, and now engaged in business at Birmingham. For four years he has been working out the system in his private workshop.

For the purpose of the experiment a double line of wire was laid along the sleepers between Horley and Three Bridges. One telephone apparatus was placed in the brake-van of the 2:03 p. m. train from London Bridge, the other was in the signal box at Three Bridges.

As the train entered the circuit at Horley, Mr. von Kramer placed the receivers to his ears and conversation took place while the train was running at forty miles an hour. A railway official then took the telephone, and, talking to an inspector at Three Bridges, asked him to repeat the message.

This was satisfactorily done, and the inventor then had another successful conversation. The fact which distinguishes Mr. von Kramer's system from any other previously tried in England or America is that there is no contact by brush between the moving train and the stationary wires. The electrical impulses travel between the "bridge" on the carriage and ground wires through an open-air space of eighteen inches.—*English Mechanic and World of Science.*

The firemen were industriously trying to extinguish a blaze in a public house one night when an impecunious Irishman who had been drinking on tick said to his friend of the brigade:

"If ye love me, Mick, play on the slate."
—*Answers.*

High Tension Phenomena

By C. F. ADAMS, Engineer of Electric Construction.

FROM Marysville running north and east is a pole line once used for the pioneer transmission from Yuba power house to Marysville. For miles it follows along the base of the big Yuba River levee, and then swings straight east for the foothills, passing through acres of abandoned gold fields, whose ditches and petty dumping grounds are still in evidence.

The original 16,000-volt line has long since been removed. The Yuba power house now feeds direct into the main Colgate lines, and a section of the old line is abandoned. The present pole line extends only from Marysville to Hammontown, leaving the main road at a point not far from Browns Valley.

The writer was recently driving along this road, returning to Marysville from Smartsville. The day was clear and brilliant. The setting sun was only a few degrees above the Coast Range. A puffy north wind blew down the Sacramento Valley. As the turn of the line toward Hammonton was reached a remarkable spectacle was presented.

Long sheets of flame streamed away from the high-tension lines and waved in the breeze. The tired horses were pulled up short, and we listened for the crackle and roar of a high tension "short." Not a sound came. The radiant streamers were flowing from all three lines and would be followed along the lines for four or five spans. Then the breeze died and the illumination ceased. What the deuce —! Again the north breeze came and again those silent glistening streamers flaunted in the air. Was this magic? Could the sunbeam and a north breeze render visible streamer corona effects? Preposterous!

Glancing down from the high tension lines, the same phenomena was seen on the telephone lines, eight feet below, and more incredible, the barbed wire fence bore the same flaunting puzzle. Then the mystery cleared. A single gleam from the tip of the buggy whip, told the whole story. A strand of spider's web illumined by the setting sun.

A myriad of tiny "sky spiders" had taken advantage of the north wind to hold an aviation meet. Their silken lines had lodged against the wires, and the setting sun had furnished the flames. "Wake up there."

As we jogged our way toward Marysville, and watched the red disk of departing day sink behind the Coast range, we wondered if the united effort of all small workers did not produce beauty if we could only see it in the proper light.

"Canal Record"

A weekly paper under the above caption is being edited and printed by the Isthmian Canal Commission, at Ancon, on the Panama Canal Zone, and, as its name implies, records the happenings along the "Big Ditch." It contains weekly and monthly reviews of the progress of the engineering work, giving the yardage excavated by steam shovels, dredgers and other equipment; the amount of concrete laid in the various locks, dams, and spillways, the building of breakwaters, and other construction work necessary to this great undertaking. Reference is made to executive orders issued by the President, notes of social happenings, and all current topics of local interest to the Canal Digger, and it is looked for with almost as much expectation as the receipt of the "States" mail.

TEACHER (to class): Who can give a sentence using the word 'disarrange'?"

Small Italian boy raises his hand.

TEACHER: "Well, Antone, you answer."

ANTONE: "My mudder she gotta da coal range. My fadda get up in da morning, maka da fire he say: "Damma 'dis a range'!"

A Timely Suggestion

By C. D. CLARKE, Superintendent North Tower Power Division.

HAVING in mind the desirability of encouraging the interest of the employees in the company's welfare, I would like to submit a couple of suggestions. The first is that at the beginning, or at any other given time, of each year, each employee be offered a certain number or fraction of shares of the preferred stock of the company, the number of shares allotted to each to be in proportion to his total wages received during the previous year. If an employee elects to purchase, payment should be accepted in small monthly installments extending possibly through more than a year with an inducement in the way of increased dividends if the purchase is completed by the end of the first year. Employees who have been with the company less than a year should also be included in the allotment. The dividends on this stock, as long as the owner remains with the company, might be higher than that on stock held by outsiders, as this should be considered not so much an opportunity allowed the employees to invest, as an investment by the company for the purpose of interesting the employees in the finances of the company, thereby making them more loyal.

The second suggestion might be considered in the light of a direct payment to the employees for their good behavior. It is that after having been with the company continuously for two years (or any other given length of time) each employee receive in addition to his regular pay-roll check a check for say five per cent of his monthly wages. After five years continuous service the percentage to be increased to ten per cent, after ten years to fifteen per cent, and so on as far as desirable.

This additional payment would have nothing to do with the employees' regular wages, being a voluntary bonus by the company, and its continuance in the case of any employee left to the discretion of the district manager, division superintendent or head of department under certain rules as to loyalty and good behavior.

In making these suggestions I have in mind principally the powerhouse and substation operators, linemen and electricians, the class that is becoming more and more in sympathy with union labor unreasonableness, my idea being that many men would remain loyal to the company before losing special privileges of this kind.

These suggestions are not original with me and probably are not new to you, but I have talked to men who have benefited by schemes of this kind and are convinced that they would tend to accomplish the results I mention.

If these suggestions are unfeasible and valueless, I hope I may not be too severely criticized for presuming to make them.

To Wipe Out the Phosphorous Match

The following clipping from the San Francisco Chronicle of January 6th, 1911, emphasizes the constantly growing realization throughout the United States, of the dangers which lurk in the use of ordinary matches:

WASHINGTON, January 5.—The "parlor" match, ordinarily used in the United States, is to be prohibited in the future if a bill introduced today by Representative Mann of Illinois becomes a law. The bill prohibits the transportation of white or yellow phosphorous matches under a penalty of a fine of $1,000 and imprisonment for three years.

PERSONALS

On Saturday, January 6th, a dinner was given by Chief Auditor J. C. Love, at his home in Berkeley, to the members of the Pacific Auditing Department.

C. R. Stevens was toastmaster, and performed his duty so well that several Chauncey Depews in embryo were discovered. Those present unanimously agreed that as an entertainer C. A. Sonneborn was without a peer, and his clever stories and character sketches were enjoyed by all. The Auditing Department Quartette, composed of Messrs. Burling, Stevens, Taylor, and Johnson, rendered several pleasing selections, while Ben Murgatroyd as a vocal soloist, accompanied on the violin by W. C. McLachlan, was a revelation to all.

A. J. Battee presented a skit entitled "Twenty Minutes Late," which he managed to get away with. It created quite a little excitement if not entertainment.

When the crowd finally departed, singing "Auld Lang Syne," everybody was certain that they had passed one of the pleasantest evenings of their lives.

D. H. Foote, genial secretary of the Pacific Gas and Electric Company, piloted the employees of his department to his new home in that Paradise of California known as Alameda, on the evening of December 14th last, where they were royally entertained. An elaborate repast, interspersed with wit, music, and song, made the evening one long to be remembered. An impromptu program was participated in by the guests and resulted in the uncovering of considerable latent talent in the Secretary's staff.

John D. Rosie gave a little exhibition of Scotch dancing and, though handicapped by the absence of kilts, did his ancestors proud. J. F. Driscoll told some true (?) stories about certain occurrences in Ireland that were rather difficult to swallow. O. H. Barthol sang "The Barber Shop Chord," which brought tears to the eyes of his hearers, while the pathetic rendition of "Silver Threads Among the Gold," by J. R. Malley, so affected Le Roy Moore that he fell asleep. The latter retaliated by telling why he, and everybody else, sleeps in Berkeley. C. E. Holt related some thrilling experiences about wild beasts he has met in the jungles of Mill Valley, and Thomas Gibney outrivalled some of tenor Caruso's phonograph records with which the guests were entertained.

When the time came to disband, those present voted host Foote a jolly good fellow, and very regretfully wended their respective ways homeward.

On November 30th last, Mr. L. H. Susman, one of the attorneys for the company, was united in marriage to Miss Mildred Tonn, a young lady well known in social and musical circles of this city. Mr. and Mrs. Susman spent their honeymoon in the southern part of the State, going as far as Mexico.

On December 22d, 1910, Mr. Thomas D. Petch, manager of the Company in Santa Rosa, was married to Mrs. Bohall of San Francisco. Hearty congratulations are extended, and we trust the Newly-Weds will enjoy a prosperous and happy New Year.

The following clipping from the Colusa Herald of December 28th, chronicles a concrete manifestation of the high esteem in which the employees of the Pacific Gas and Electric Company are held by our consumers.

George F. Scott gave a suit of clothes worth $40 to C. J. Fitzgerald, the hand-

some and accommodating man who goes about seeing that your gas fixtures are all right and the meters not loafing on their job.

Mr. Fitzgerald is the local Gas Service man of the Colusa District.

Miss Margaret Wardlow, who has been in charge of the telephone board in the office of the Sacramento Electric, Gas and Railway Company for the past three years, has as of January 1st, 1911, accepted a position as head telephone operative of the State Capitol, having been appointed to this position by the Secretary of State, Frank Jordan. Miss Wardlow is succeeded by Miss Kenealy.

Miss Daisy Thatcher became the bride of W. C. Russell at a ceremony performed in San Francisco Tuesday, January 10th. Mr. Russell is a popular young employee of the Pacific Gas and Electric Company. He is well and favorably known, in Marysville as well as in this city, where he has worked. At present he is in charge of a substation near Chico, and is a competent electrician.

New Use for the Slide Rule

R. C. Powell, of the Oakland Gas Light and Heat Company, was before the Berkeley Court this morning for exceeding the speed limit. The arresting officer admitted that Powell had slowed up to about ten miles an hour crossing the railroad track. Powell pulled out his slide rule—it 's always with him—and then showed the Court that if he got down to ten miles there in order to cover the remaining distance in ten seconds, with which he was charged speeding over eighteen miles, he would have had to reach twenty-six miles, which speed is not in the machine or could have been reached in the time or distance. The Court became interested in the slide rule proposition with the result that it was used on the next case and both were dismissed.

Sacramento Fifty Years Ago

From the *Sacramento Bee*, December 17, 1860.

GAS.—A large number of gas consumers in Marysville pledged themselves to each not to use any more gas unless the company would sell it to them for $9.50 per thousand feet. The company says it now furnishes the City Hall, Station House, engine houses and other public buildings in that city free of charge, and if the Council will pay for the gas consumed therein it can afford to make a reduction to consumers.

Marysville Fifty Years Ago

From the *Sacramento Bee*, December 19, 1860.

The Marysville Gas Company has decided to reduce the price of gas to $10 per 1,000 on and after January 1st, 1861. The consumers asked that it be reduced to $9.50.

A Remarkable Cable

The Standard Underground Cable Company has a sample of cable which was manufactured at their Pittsburgh factory in 1886 and was installed in Philadelphia in 1886. The cable was manufactured for 600 volts working pressure and was operated at that pressure for several years when the voltage was increased to 2,000, at which voltage the cable was operated until a change in the system necessitated taking it out in 1910, after the cable had been in continuous service for over twenty-four years. The copper, insulation (fibre saturated with Ozite compound), lead and outer covering of saturated braid, are in excellent condition and practically as good as the day the cable was first placed in service.

The highest compact we can make with our fellow is: Let there be truth between us two forevermore. It is sublime to feel and say of another, I need never meet, or speak, or write to him; we need not reinforce ourselves or send tokens of remembrance; I rely on him as on myself; if he did thus or thus, I know it was right.—*Emerson.*

Responsibility for Defective Cross-arm

From *Electrical World*, May 19, 1910, p. 1303.

The Court of Appeals of Maryland has decided that an electric light and power company is not liable for injuries to a lineman in the employ of another company caused by the breaking of a cross-arm where the cross-arm was not defective when originally placed in position, nor is the company by which the lineman was employed liable in such a case. If an electric company has, to the knowledge of its linemen, a regular system of inspection of the poles and cross-arms, independent of what the linemen themselves would be supposed to make, the linemen would have the right to assume that the independent inspection had been made; but when the employer has no such independent system of inspection and the lineman has no reason to believe that such inspection is made, he has no right to rely on the employer for such inspection but must make such tests for himself as may be necessary to ascertain whether the poles and cross-arms are safe.

A national census on the number of licensed automobiles in the United States, 500,000; shows that California ranks second, with 40,000; New York State leading with 64,000, and Massachusetts third with 39,000. The fact that California, with a population of 2,377,556, as against, New York with a population of 8,865,722, ranks second, is probably due to the fact that there is no State in the Union where automobiles are so generally used for business purposes, and touring, which is carried on almost as extensively during the winter months as in the spring and summer.

Charity and personal force are the only investments worth anything.—*Walt Whitman.*

Easy Process for Estimating Water in Petroleum

By R. Rightwick Roberts and Alfred Fraser. From *The Chemical Engineer*, June, 1910, p. 171.

A 300cc. flask is closed at the top by a cylindrical funnel, which is connected to a tube extending to the bottom of a 5 litre bottle through a hole in the cork. A similar tube extends from the bottom of the bottle through the cork and connects with a tube resting loosely in a graduate. 17.24 grams of the petroleum are placed in the flask, a few fragments of calcium carbide are put into the funnel, and about 20 grams of finely ground carbide are poured on top of these. A few taps of the finger cause the finer carbide to fall into the flask, which is gently shaken. Evolution of acetylene begins immediately, and the gas, passing into the bottle, causes an equal quantity of water to overflow into the graduate. Each 100 cc. of the corrected volume of the gas indicates 1% of water in the sample.

If the oil is very thick, about 20 cc. of kerosene are added.

The Man Who Wins

The man who wins is the man who does,
Who makes things hustle and hum and buzz;
The man who works and the man who acts,
Who builds on a basis of solid facts;
Who does n't sit down to mope and dream,
But humps ahead with the force of steam;
Who has n't the time to fuss and fret,
But stakes his money and wins the bet.

The man who wins is the man who wears
A smile to cover his burden of cares;
Who knows that the sun will shine again,
That the clouds will pass and we need the rain;
Who buckles down to a pile of work
And never gives up and will not shirk
Till the task is done and the toil made sweet,
While the temples throb with the red blood's heat.

The man who wins is the man who climbs
The ladder of life to the joyous chimes
Of bells of labor and songs of cheer;
He is n't afraid of the critic's sneer,
For he faces the glow of the mid-day sun
And works in the light till his task is done—
And makes things hustle and hum and buzz;
The man who wins is the man who does.

—FOLGER MCKINSEY, *in Baltimore Sun.*

C. M. Hansen, one of the best-known boiler and fly-wheel insurance men in the United States, has been appointed manager of the Steam Boiler, Fly Wheel and Inspection Department of the Pacific Surety Company. Mr. Hansen is well known as one of the foremost authorities on this class of insurance, and has been for many years connected with leading companies in a similar capacity. It is becoming generally understood that casualty insurance is an engineering problem, and under Mr. Hansen's able management the department's aim will be to provide solutions and preventives.

The Sangamo Electric Company, Springfield, Illinois, are distributing a series of bulletins showing the various elements of their well-known mercury flotation ampere hour and watt-hour integrating meters. The detailed drawings which illustrates the non-spillable mercury chamber should prove of much interest to meter superintendents, as they constitute a valuable addition to meter literature.

The Sangamo Electric Company, Springfield, Illinois, have just made a large shipment of integrating mercury flotation watt-hour meters to Manila, Philippine Islands. Owing to the long shipping distance involved, it was important that a type of meter be selected that would withstand rough usage without injury, and the mercury flotation type was judged by the purchasing engineers to be particularly well adapted to meet the conditions. This is another instance where American-made products are successfully competing with the foreign designs.

Mr. M. B. Chase has resigned his position with with the Westinghouse Electric and Manufacturing Company, Boston office, to accept the position of New York Manager for the Sangamo Electric Company of Springfield, Illinois, who have opened offices in the Hudson Terminal building, 50 Church Street.

The increasing eastern business of the Sangamo Company has necessitated direct representation in New York, and the long experience of Mr. Chase in the design, manufacture and sale of meters especially fits him to take up the sale of Sangamo products, which now embrace a complete line of alternating-current and direct-current integrating watt-hour meters, ampere-hour meters for stationary battery and vehicle work, portable and switchboard type graphic recorders. A complete line of indicating instruments, both portable and switchboard forms, have been designed and will be offered for sale within a few months.

A new factory is practically completed at Springfield, which will enable the Sangamo Company to take care of their very rapidly increasing business.

The following is from a sales report of the Remington Typewriter Company:

The San Francisco Gas and Electric Company have installed several Wahl Adding and Substracting machines.

The Pacific Telephone and Telegraph Company have recently installed eighty-four Remington typewriters with Wahl Adding and Subtracting Attachment for toll billing in their various offices on the Coast.

The Wells Fargo Express Company are installing these machines for their abstract and statement work, adding at one operation eight columns at a time.

The Southern Pacific Company have recently installed Remington waybilling and expense billing machines at Fourth and King Streets, also the Wahl Adding and Subtracting machine doing all work where typewriting, adding and subtracting are combined.

Other recent sales are to the Wells Fargo Nevada Bank, Union Trust Company, Crocker National Bank, Anglo, London and Paris Bank, Bank of California, Mercantile National and Western Metropolis.

QUESTION BOX

Ask questions. Any one of the several thousand men and women in the Pacific Gas and Electric Company who wishes information pertaining to any phase of the company's work or concerning matters of common interest to residents of any section reached by the company's lines is urged to use this department freely. Send your questions to the magazine. There will be no charge.

Query.—Is the registration of a gas meter affected by the pressure of the gas passing through it?

Answer.—No. Not through possible ranges of pressure.

Query.—If not, how can the loss in the system be correctly determined by taking the difference in the readings of the input and output meters?

Answer.—As there is no loss or variation, no correction is necessary.

Query.—Does not the well-known law of gases, that the volume varies inversely as the pressure, apply, and unless the pressures in two meters are the same the volumes as recorded by the meters will not be the same?

Answer.—Yes, the law of volume and pressure applies; but volume is not reduced to one-half until pressure is doubled. This refers to atmospheric pressure of 14.7 pounds per square inch, and as the usual pressure of gas is only four inch of water above atmosphere, the increment of pressure is only one-seventh lb., approximate, or about one per cent difference in volume.

Query.—What method should be used to compare 10,000 cubic feet of gas at $1.00 per thousand to kilowatt basis, and what would be the difference in cost at 10 cents a kilowatt?

Answer.—Tungsten lamp uses $1\frac{1}{4}$ watts per candlepower, which equals 800 candlepower per kilowatt or 8,000 candlepower for one dollar. A single reflex burner Welsbach gas lamp with holophand shade gives 230 candlepower on a consumption of $3\frac{1}{3}$ cubic feet of gas, or 69,000 candlepower for one dollar with gas at $1.00 per thousand. Ten thousand feet of gas would give 690,000 candlepower; $862\frac{1}{2}$ kilowatts would give 690,000 candlepower, with electric energy at 10 cents per kilowatt hour.

Cost of gas . . .	$10.00
Cost of electricity .	86.25

Query.—What effort is being made to educate employees to intelligently answer the questions asked by consumers?

Answer.—By frequent talks on educational lines, meetings between employees and heads of departments, and other means which we hope to improve from time to time, aided by the intelligence of our men.

Query.—Is any systematic effort being made to convince gas consumers of the accuracy and reliability of the gas meter?

Answer.—Yes, by advertising as far as possible and by a glass meter in our business office, illustrating its action.

Query.—What leaks that occur in gas meters show a loss to the company and also to the consumer?

Answer.—Leaks before inlet of meter and in the meter itself are losses to company; any leak beyond outlet of meter is a loss to consumer.

The Population of the World

Actors who played with Booth and Barrett	11,456,189
People who knew you when you were poor	78,546,987
Oldest inhabitants	56,187,354
Assorted liars	356,456,100
People with a grievance	108,567,876
People who remember you when you were "so high"	76,345,567
"Old Subscribers"	64,456,732
Damphools (all varieties)	763,453,657
	1,457,378,962

PACIFIC GAS AND ELECTRIC COMPANY

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The Pacific Gas and Electric Company

SUPPLIES

LIGHT, HEAT, AND POWER

TO

Place.	Population.	Place.	Population.	Place.	Population.
Agua Caliente	50	**Fair Oaks	250	Peyton	250
*Alameda	23,383	Fitchburg	250	**Piedmont	2,000
**Albany	800	Folsom	1,500	Pinole	1,500
‡Alta	200	*Fresno	35,000	Pleasanton	2,000
Alvarado	200	Glenn Ellen	500	Port Costa	600
Amador	200	Gold Run	100	**Redwood City	3,500
Antioch	3,000	Grafton	350	Richmond	10,000
‡Auburn	2,050	†Grass Valley	7,000	Rio Vista	200
Barber	200	Gridley	1,800	‡Rocklin	1,050
**Belmont	600	Groveland	50	Rodeo	100
Belvedere	350	Hammonton	500	‡Roseville	345
Benicia	2,500	Hayward	4,000	Ross	900
**Berkeley	40,434	Hollister	3,000	***Sacramento	52,000
Big Oak Flat	150	Ione	900	San Andreas	200
Biggs	750	Irvington	1,000	San Anselmo	2,500
Black Diamond	500	Jackson	2,000	San Bruno	1,500
Brentwood	200	Jackson Gate	50	San Carlos	100
Brighton	100	Larkspur	950	**San Francisco	416,912
Broderick	500	Lawrence	100	**San Jose	40,000
‡Brown's Valley	50	Kennedy Flat	50	San Leandro	4,000
**Burlingame	5,000	Kentfield	200	San Lorenzo	100
Byron	200	‡Lincoln	1,500	**San Mateo	7,000
Campbell	1,000	‡Live Oak	200	San Pablo	1,000
Cement	1,500	Livermore	2,250	**San Quentin Prison	1,600
‡Centerville	20	‡Loomis	150	**San Rafael	6,000
Centerville	500	Los Altos	200	Santa Clara	8,000
**Chico	13,000	Los Gatos	3,000	Santa Cruz	10,000
**Colusa	2,700	Mare Island	500	**Santa Rosa	8,000
‡Colfax	400	Martell	25	Saratoga	200
Colma	500	Martinez	5,000	Sausalito	3,000
Concord	1,500	**Marysville	6,250	Sebastopol	2,000
Cordelia	150	Mayfield	1,500	Selby	100
Corte Madera	350	**Menlo Park	1,500	Sonoma	1,200
Crockett	2,500	Meridian	300	South San Francisco	2,500
Crow's Landing	375	**Milbrae	300	Stanford University	2,000
Davenport	1,000	Mill Valley	4,500	Stege	100
Davis	750	Mission San Jose	500	‡Stockton	25,000
Decoto	350	Mokelumne Hill	150	Suisun	1,200
Dixon	1,000	Mountain View	2,500	Sunnyvale	2,000
Dobbins	50	**Napa	6,000	Sutter Creek	2,000
Drytown	100	†Nevada City	4,000	Tiburon	100
Durham	500	Newark	700	Tormey	150
‡Dutch Flat	400	‡Newcastle	600	‡Towle	200
**Easton	500	New Chicago	25	Tracy	1,200
**East San Jose	1,500	Newman	1,000	Vacaville	2,500
Eckley	20	Niles	800	**Vallejo	12,000
Emerald	50	**Oakland	150,174	Vallejo Junction	10
Elmhurst	2,500	Oroville	2,500	Walnut Creek	350
Elmira	150	Orwood	50	Warm Springs	200
El Verano	100	Pacheco	200	Wheatland	1,400
**Emeryville	2,000	**Palo Alto	6,000	Winters	1,200
Encinal	20	‡Penryn	250	**Woodland	3,500
Fairfield	800	Perkins	200	Yolo	350
		**Petaluma	6,000	**Yuba City	1,900

*Gas only; **gas and electricity; †electricity, gas, and water; ‡electricity and water; ***gas, electricity, and street-car service; unmarked, electricity only.

Service Furnished	Number of Towns	Total Population
Electricity	158	1,089,790
Gas	33	988,900
Water	17	43,415
Street-Car	1	52,000

EMPLOYS 3,500 people
OPERATES 11 hydro-electric plants in the mountains
3 steam-driven electric plants in big cities
18 gas works

SERVES ⅔ of California's population
26 of California's 56 counties
An area of 32,431 square miles
⅗ the size of New York state
½ the size of all the New England states combined

Pacific Gas and Electric Magazine

Vol. II | Contents for February | No. 9

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IN A BROWN STUDY.

PACIFIC GAS AND ELECTRIC MAGAZINE

VOL. II FEBRUARY, 1911 No. 9

Electric Power Plant Economics

By ERNEST B. PRICE, of the Department of Operation and Maintenance.

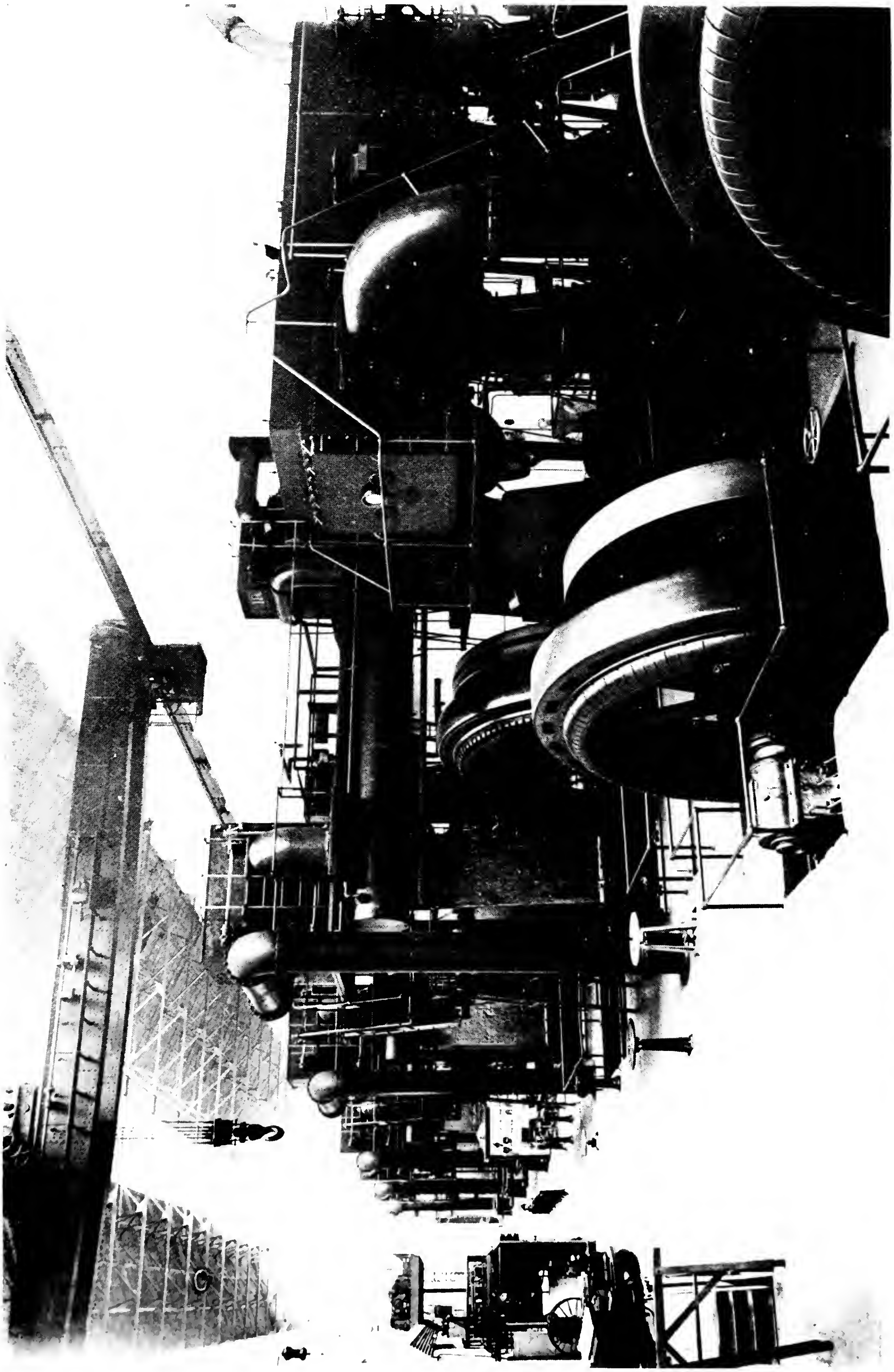
Ernest B. Price

ECONOMY is a science, and by economy I do not mean the penny wise and pound foolish tactics, but the intelligent handling of men and money, to produce the highest return on a given investment. Someone has aptly defined an engineer as a man who could obtain a given result with one dollar, where the untrained man would require two dollars and then not get anything. The Mecca towards which all great operating engineers are traveling—those engineers who play the game for the sake of the game, and who set their normal working standard at one hundred per cent higher than the man of small capacity—is to so manoeuver men, money and apparatus, that the greatest benefit to their Company is derived from the least expenditure of the Company's money, without in any way jeopardizing the service. The operating engineer is virtually playing a great game of chess, his chessmen being, perhaps, a new motor generator set, a water wheel, or a new steam turbine, or perhaps the advisability of certain changes in operation at one particular point and the advantage to be gained by certain new installations involving the expenditure of the Company's money.

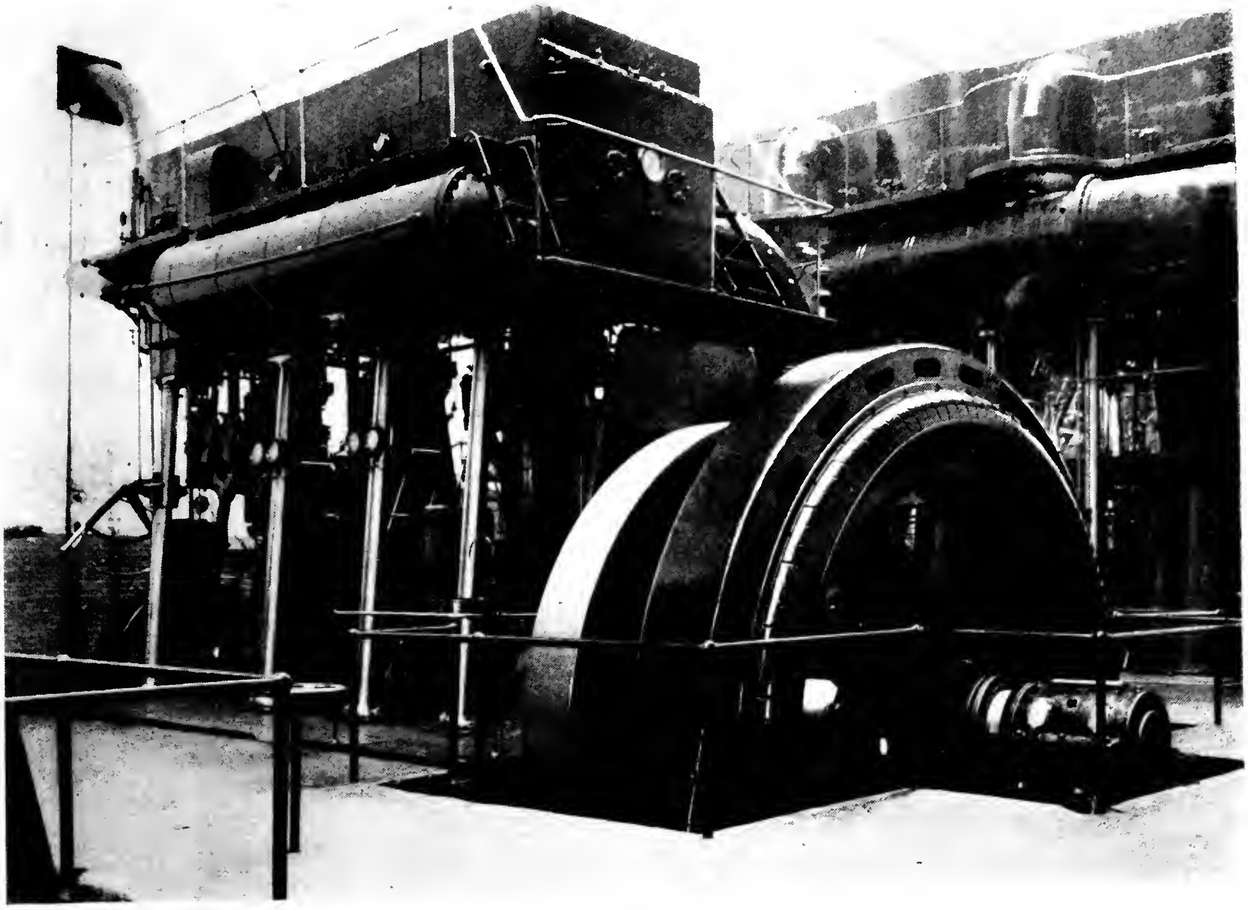
Sometimes false moves are made in the game, and as the operating engineer carefully studies his chessboard, while seated opposite that ever present silent opponent, Results, he knows that each move must be sure and certain, if he hopes to maintain his firing line intact and win.

Some of the above facts impressed themselves on me while recently standing on the engine-room floor of our large generating station at 23rd and Louisiana Streets, and known as Station "A." As probably many of our readers do not know, we have just completed the installation of a new turbine at this station, similar in design to that installed at the Oakland plant, but of larger capacity. As I looked down the long avenue of silent engines, my mind was carried back to the days of the rope drive engine; then of the triumphant march of the direct connected engine, and now today, with hardly the flush of victory gone, these same warriors were humbled in the dust before the onward march of their latest rival, the steam turbine. Just what these war-stained veterans said to each other is not a matter of history, but to me they stood as mute examples of the inevitable law of progress, and I was impressed with the analogy between the fate of men and machinery, in that length of service spells absolutely nothing, unless results are being obtained in the present.

This steam turbine, therefore, is the latest



Some of the veterans of Station "A," honorably discharged from active duty, but held in reserve.

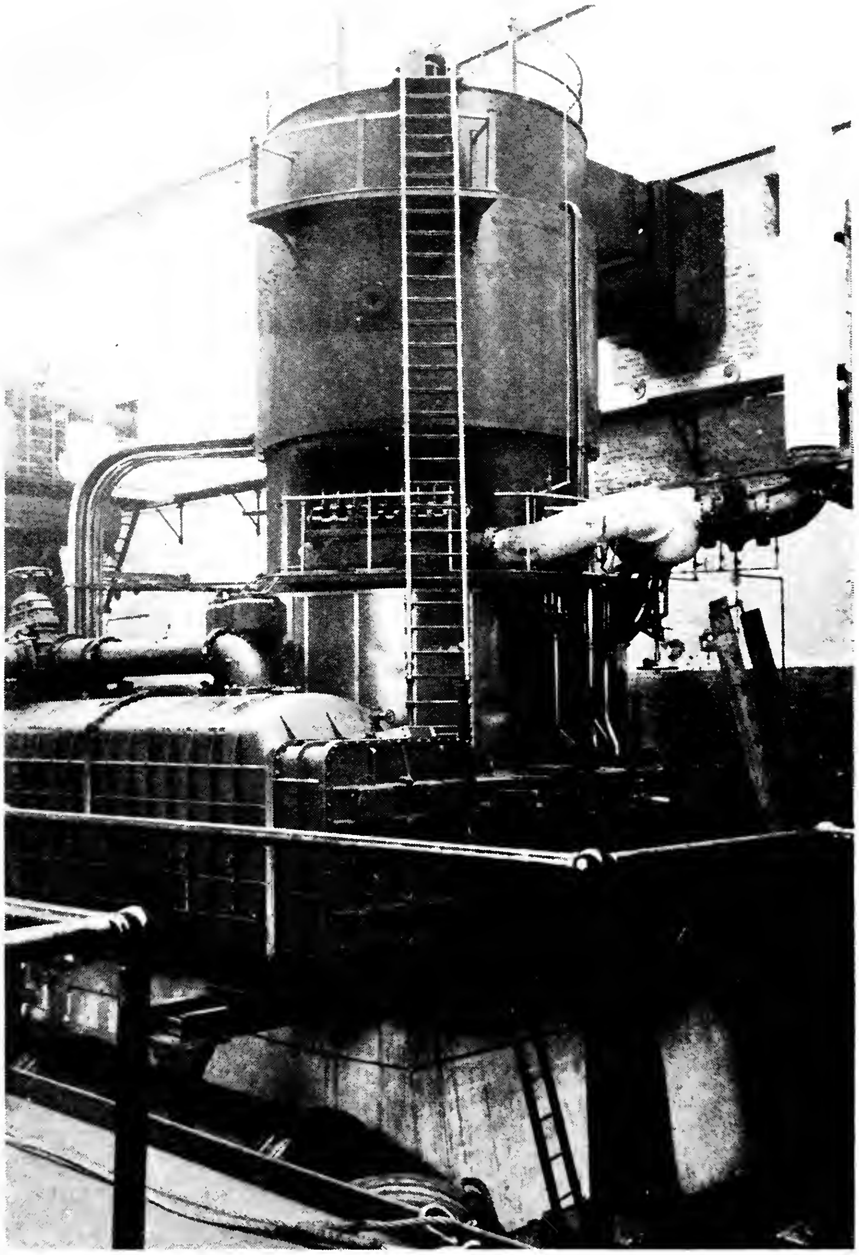


One of the old guards of Station "A"—a 1500-kilowatt Triple Expansion Engine—typifying the modern Vertical Reciprocating Engine.

move on the chess-board of the Operating Department. Its installation means the shutting down of less efficient apparatus, and a consequent saving in fuel oil expense, labor and supplies. These are many interesting features in connection with this new arrival. As will be seen from the photograph, the condenser is contained in the base of the turbine. This condenser has 6,000 tubes, and when placed end to end they would extend for nineteen miles. The condenser demands 25,000 gallons of water every minute, which means 36,000,000 gallons every day, and when you place 35,500,000 gallons of water beside this figure, the latter being the average daily consumption of water of the City of San Francisco, the mind is able to grasp the enormous amount of water necessary.

In the matter of floor space in the engine-room household, the turbine with its auxiliaries occupies less space than the triple expansion engine shown in the photograph, but it has ten times more capacity, and in the matter of economy of operation the turbine has reduced the fuel oil bill 33 1-3 per cent, the maintenance and repair account about 25 per cent, and the labor 14 per cent. It is apparent, therefore, how closely the technical and commercial interests of a great corporation are interlocked, and how delicately sensitive is the Company balance sheet to the extravagant or economical policy of the construction, operating, and distributing departments.

Following this introductory article, it is the intention of this department to develop the steam turbine by a series of semi-technical articles, which we feel sure will be of interest to our readers for the old proverb stating that one-half the world is in ignorance of what the other half is doing, is well illustrated in our



Our 15,000-kilowatt Steam Turbine at Station "A," typifying the latest development in prime movers. Note the compactness of this unit with ten times the power of the Reciprocating Engine.

own Company. As we sit at home or at the theater, we perhaps forget the anxious face in the boiler-room, the engine-room, or before the switchboard, and the care, foresight and energy necessary to maintain a continuous flow of current through the subdued night lamp of the sick room, the blaze of light from the glittering chandelier, or the golden glow of a great city at night, as viewed from some distant vantage point.

Main Street, Antioch, looking toward the business section.

The Industrial Department and You

By H. P. PITTS, Industrial Engineer.

H. P. Pitts

The Industrial Department of the Company came into being without any notoriety and fuss, and it has been working quietly and actively during the several months of its existence, along the lines for which it was created.

The need had long been appreciated for a department which could give its whole time and attention to the power and lighting needs of prospective customers, examining the prospect from a technical standpoint, but couching its report in plain readable business English. Then, too, there was recognized the importance of being ready to help existing customers cut out losses and wastes in their lighting and power, of giving them expert advice in the re-organization of their motive power, of assisting them in solving their lighting problems, in short, of making the Company's service of the utmost possible value to them.

The Industrial Department was created to give its services to the intending or existing customer, free of cost to him, thus saving him entirely the consulting engineer expense which he would ordinarily have to stand to get a satisfactory result.

Read the following typical report of a city water supply pumping project; this case was selected at random from the files of the Industrial Department as an illustration of the kind of work done and the kind of report made on it:

(Copy of Letter).

December 10, 1910.

Mr. —— ———,

Mgr. Contra Costa District,

Dear Sir:—

From the information and data received from you and from that gathered while going over the proposition in person, it is evident that we can show the people of Antioch that not only would a duplicate pumping system there be a very important feature in lowering insurance rates, but it would be advantageous from a cost point of view to duplicate the system, using an electric motor and centrifugal pump and operate it in place of the present steam plant.

From information gathered (and I might say that every opportunity was afforded for obtaining same), the Worthington steam pump at present is raising 25,000 gallons of water per hour about 130 feet, or, under a pressure of 57 lbs. per square inch. Add to this the friction of pumping such a quantity of water through a 6″ pipe 1,000 feet long, which causes an additional 9 lbs. of pressure, makes a total head of 65 lbs. pressure which is to be pumped against. The horsepower required to do this work, assuming a pump efficiency of 60% is calculated as follows, viz:

65 lb. pressure is equal to 150 ft. head.
10 ft. suction is equal to 160 ft. head total.
25,000 gals. per hour is equal to 417 gals. per minute.
1 gal. water is equal to 8.3 lbs.
Horsepower required to do work at 60% efficiency is:

$$\frac{417 \text{x} 160 \text{x} 8.3}{33000 \text{x}.60} = 28 \text{ horsepower.}$$

The information was that the quantity of water required at the present time was approximately 250,000 gallons per day, or, that the present pump could do the work required in 10 hours running. In the summer time the requirement ran up to as high as 400,000 gallons per day. Under these conditions the pump was operated a greater number of hours per day.

The oil bills are as follows:

June 30....	197 bbls.	
July 30....	234 "	
Aug. 8....	231 "	
Oct. 20....	184 "	
Nov. 15....	206 "	
	1,052 "	@ $1.05=$1,104.60

There is no record of oil being bought in September, so we will assume that the consumption is spread over a period of six months, or $\frac{\$1,104.60}{6} = \$184.10$ per month. The quantity of oil used per month, however, cannot be averaged, as larger amounts are used in the summer months; neither can it be calculated in the ratio that 250,000 is to 400,000, as the larger quantity is seldom required. Let it be assumed that for November 80% of the average is used ($184.10x.80); and the oil bill is shown to be $147.28; add to this $150.00 for salaries and a charge for cylinder oil, boiler compound, etc., of $5.00 per month, makes the total cost for the month $302.28 to operate the plant at present.

To operate such a system electrically, the same horsepower should be used as a basis of calculation, namely, 28. Reducing this amount to kilowatts, 28x.746 is equal to 20.89 kilowatts. There will be a loss in the motor, however, and to be liberal an efficiency of 85% will be assumed, $\frac{20.89}{.85}$ equals 24.58 kilowatts. Operating this at ten hours per day to obtain 250,000 gallons of water would consume 24.58x10 equals 245.8 kilowatts hours per day which, at 2c per kilowatt hour (245.8x.02) equals $4.916 per day, or ($4.916x30) $147.48 per month for electric current.

The chief advantage in using the electric motor is that the labor could be cut in half, or, reduced to one man, inasmuch as the plant would require little attention, as automatic devices are obtainable for the purpose of cutting off the current when the tank is full, and as the tank holds several hours' supply under extreme conditions, immediate attention is not required.

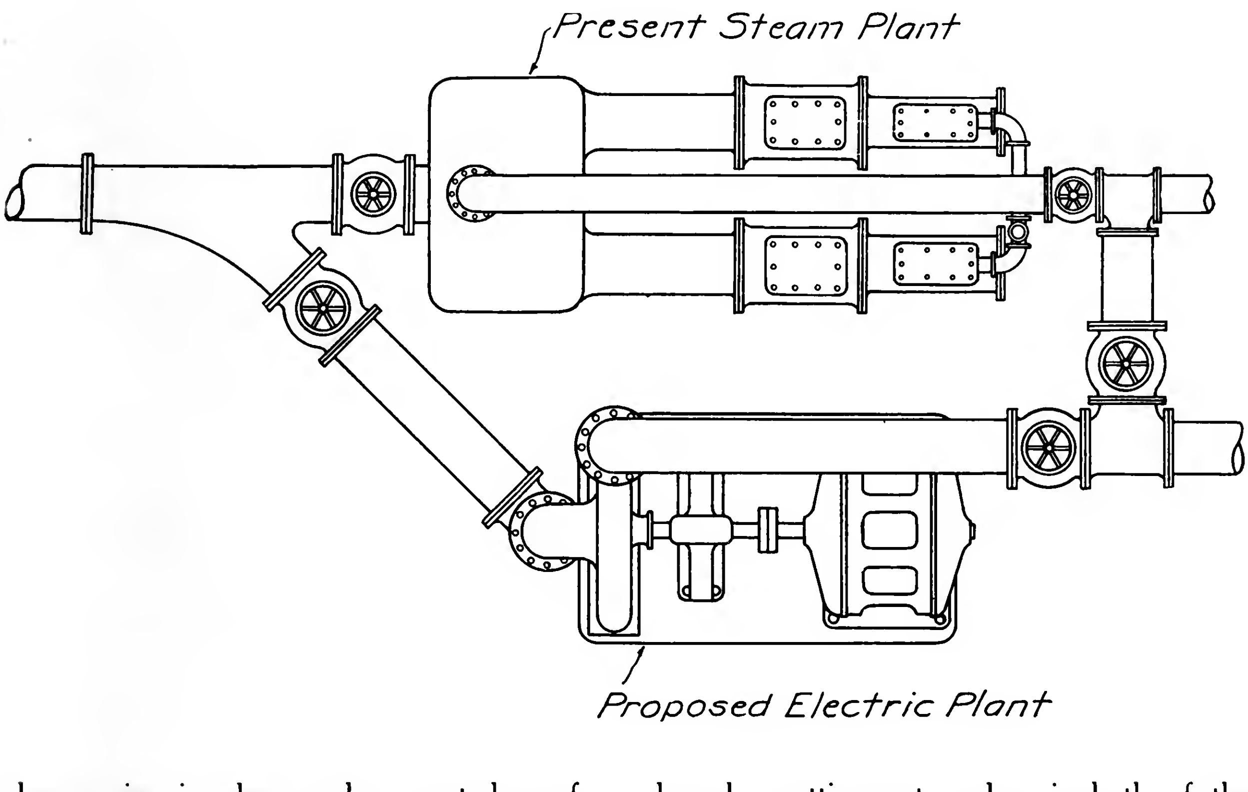
The total estimated expense for the month of November, and under the same conditions as the steam is calculated, would be $147.48 plus $75 equals $222.48 as against $302.28 for steam, a saving of $79.80 per month.

It would not appear advisable to install a small unit, as the above calculations are based on, and I would strongly advise that not less than a 500 gallon per minute pump be installed. While this would increase the first cost of the apparatus, the cost of electric current per gallon of water pumped would be the same, naturally.

An electric motor and centrifugal pump, mounted on a cast iron base, to meet the above conditions (500 gallons per minute against a head of 65 lbs.) would cost in San Francisco about $650.00. The matter of making connections in order to change from one pump to the other, in case of necessity, means probably another $150.00.

The President of the Board of Trustees informed me that an 8″ discharge pipe between the pump and the tank was contemplated. This would be an ideal plan, as not only would it reduce the friction in pumping, thereby cutting down the cost per gallon pumped 4%, but by retaining the 6″ discharge pipe in place and connected up for emergency purposes, the insurance rates in the city would be reduced, a feature which has not been touched upon as yet. The latter feature is one that will be appreciated by the property owners and people of Antioch more than any other. From calculations made it shows up that were a duplicate pumping system installed and a duplicate discharge pipe maintained, the insurance rates would be reduced in Antioch to from 3% to 5% on all brick buildings, and from 5% to 10% on frame buildings. This feature should be emphasized and brought to the notice of everyone interested, as this alone warrants the additional expense of the duplicate system.

The plan which I would suggest would be to install the electric pumps alongside of the present steam pumps, leaving room between the two pumps to be able to get at and repair either. This would give a suction of about 8 to 10 feet for the centrifugal pump, which is ideal. To make the connections, a cast iron Y piece would be placed in the suction pipe, just back of the steam pump with gate valve to cut off the pump not in use. The discharge end of the centrifugal pump would be connected to the new 8″ discharge pipe, with a cross connection between the present 6″ discharge pipe, so that either pump could be discharged into either pipe. This could be done by putting gate valves in both of the discharge pipes, next to the pumps, then beyond using T's for the cross connections, with a gate valve between pipes, all of which is shown on accompanying sketch.



The whole proposition should appeal to the Trustees, as every feature of it is a saving one and the first cost is nothing as compared to the benefits derived. From the fact that a number of cities have changed over to electric drive and are operated by our system, namely, Santa Rosa, Napa, Woodland and others, there need be no fear of the successful operation, especially as in the past several years our system has been improved so that interruptions are a rarity.

Should there be any feature not touched upon in this matter that I can be of service to the Trustees of Antioch, or to yourself, kindly get in touch with me and the department will be at your service.

Yours truly,

....

Industrial Engineer.

That was plainly put, was it not? Just as clear an analysis will be made of your problem, at your mere request, you who are reading this article, whether you be our customer, an intending customer, or a district manager.

Let the Industrial Department know of your need; perhaps you are concerned with the installation of a three-horsepower motor in a carpenter shop; it may be the lighting of your store or buildings which is worrying your pocket-book; let the Industrial Department know about it—it exists solely to help you.

Excerpts From an Address by Mr. A. S. Huey

First Vice-President of H. M. Byllesby & Co., Chicago

TO MANY, the possession of a public utility franchise is only an opportunity for personal gain. To the conscientious man such possession means an opportunity of administering to the public welfare. A city, in granting a franchise, not only places in the hands of the grantee an asset of value, but makes the grantee a trustee of the public good. The term itself, "public utilities," implies being useful and therefore of benefit to the public. To attain this end, service must be competent. Along with this grant go certain legal restrictions and rights."

"We as managers and operators of electric, gas, street railway and telephone properties, prefer to hold our franchises by retaining the confidence of the people; to hold the privileges conferred by the public, not by right of law, but by right of merit.

"It follows that the company and the public are partners in the enterprise. On the one hand we who invest the capital, the time and the energy, expect compensation measured in dollars and cents. On the other hand the public expects good and adequate service at fair rates. It has just as much right to expect these things as we have to anticipate proper financial reward.

"It may be worth while to list specifically to what we believe to be the principal obligations of both parties to a franchise.

"The obligations of a utility company include the following:

"First—Rendering of good, adequate and continuous service.

"Second—Fair and reasonable rate schedules.

"Third—No discrimination among customers of the same class, or between classes of customers for like service.

"Fourth—Extension of service into all populated sections of the municipality and suburbs.

"Fifth—Earnest endeavor to market the greatest possible volume of service.

"Sixth—Adoption of approved inventions and development in machinery and apparatus.

"Seventh—Sound financial management.

"Eighth—A high standard of physical maintenance.

"Ninth—Public spirited attitude in all matters concerning the general welfare and advancement of the community.

"Tenth—Broad and liberal business administration.

"Eleventh—Keeping faith with the people in all agreements, promises and announcements.

"Twelfth—Strict obedience to law, and no participation in politics.

"So much for our duties and responsibilities as we comprehend them. Granted that the utility corporation lives up to this code, what is due from the public."

"First—The same degree of confidence, encouragement and respect that one business man accords to another; that any citizen expects from his neighbor.

"Second—Willingness to permit a fair profit on the capital, energy, ability, and risks embodied in the undertaking, to permit a profit greater than mere interest which could be obtained without effort or hazard.

"Third—Disregard of attacks by popularity-seeking agitators.

"Fourth—Willingness to recognize and reward improvements in service.

"Fifth—Recognition of the fact that the operation of utilities differs fundamentally from merchandizing or manufacturing.

"Sixth—Reasonableness in demanding large capital outlays for improvements not strictly necessary to the rendering of adequate service, such as placing wires underground in cities of small and medium size.

"Seventh—To make prompt payment of bills, because the company cannot render the service demanded if its only source of income is retarded.

"Eighth—Protection against direct competition. All authorities agree that public utilities can be conducted with greatest benefit to the public as controlled monopolies.

"Ninth—Careful consideration of legislation, municipal, State and national, which would hamper and curtail the development of utilities.

"Tenth—Recognition of the fact that, starting from a given base line, which varies in different localities, reduction in rates can be secured without financial loss only by increasing the volume of service sold.

"Eleventh—Recognition of the fact that no utility company can well serve a municipality if it is not in prosperous condition, and able to secure the investment of new capital on favorable terms.

"Twelfth—Treatment of all questions affecting public utilities in a fair minded way, looking upon them as business questions without regard to political considerations.

"In few lines of endeavor do petty practices cost so dearly as they do in the operation of public utilities. It is suicidal to adopt a policy bounded by the strait-laced terms of contract and franchise, capsheafed by the motto "We don't have to."

"The "we don't have to" spirit, gentlemen, has caused unmeasured and well-deserved woe to public utility corporations. It was one of the mortal sins of the old-time operator, and we of the present day are still doing penance for its commission.

"If a man from the outskirts of your city comes into the office and asks that the electric lines or the gas mains be extended to serve him, you should not dismiss him with a curt reply. You should explain how a company's first duty is to keep itself solvent, and that doing as he wishes, without first altering conditions so as to protect the company against loss, would be a breach of trust not only to your stockholders, but to a great majority of the local public. Then try, you and he together, to work out a plan satisfactory to both.

"It is particularly important that we should avoid participation in politics. Nothing will more quickly arouse dissension and antagon-

ism. The utility company serves not a political party, but the body politic.

"We cannot be expected to achieve a liberal and satisfactory administration if every act of the company is regarded with suspicion and every move in the interests of better service is looked upon as an effort to extort money from a public.

"Whatever reason may have existed in the past for such an attitude, exists no longer in companies progressively managed.

"We are entitled to protection from poorly considered legislation. Often laws calculated as reforms turn out to be burdensome to people and corporation alike.

"This point I can emphasize by quoting from a recent address of Edward M. Bassett, a member of the Public Service Commission of the State of New York for the First district. Mr. Bassett said:

"Efficiency in a public utility corporation redounds not only to the benefit of the public, but should redound to the benefit of the corporation itself. That saving which comes from thrift—that greater earning capacity which comes from ingenuity and faithfulness—is properly divided between the public and the corporation itself, not forgetting the payment of good wages, and the making of permanent and prominent positions for those that contribute to that result.

"I for one am of the opinion that public regulations should incite and increase and encourage private initiative. Thrift, economy, better results for a certain amount of work, more electricity for a certain number of pounds of coal—that efficiency should not be entirely, or anywhere near entirely, taken advantage of by the public. The corporation that can produce results is entitled to a large measure of the benefits of its own efficiency and progress."

"The more enlightened view regarding the regulation and treatment of utility companies was given a partial expression in the recent annual message of Governor Charles S. Deneen of Illinois. Governor Deneen advocates regulation by a State commission empowered to collect accurate data, require adequate service and, to quote his exact words "to fix rates which will be fair to the public, will assure to investors a reasonable return upon their investment, and will offer inducements for the investment of private capital in public service corporations to stimulate their growth as the public needs may require."

"If a management is progessive and conducts the business as a public trust, the terms of its franchise matter little. On the other hand, if the management refuses to recognize the equity of the public and declines to be liberal and fair, that management will go down to merited defeat and financial loss, regardless of the most liberal franchises ever granted.

"Now, gentlemen, in closing let me suggest for your further guidance that you approach your work in a spirit of optimism—

'Twixt optimist and pessimist,
The difference is droll—
The optimist sees the doughnut;
The pessimist, the hole.

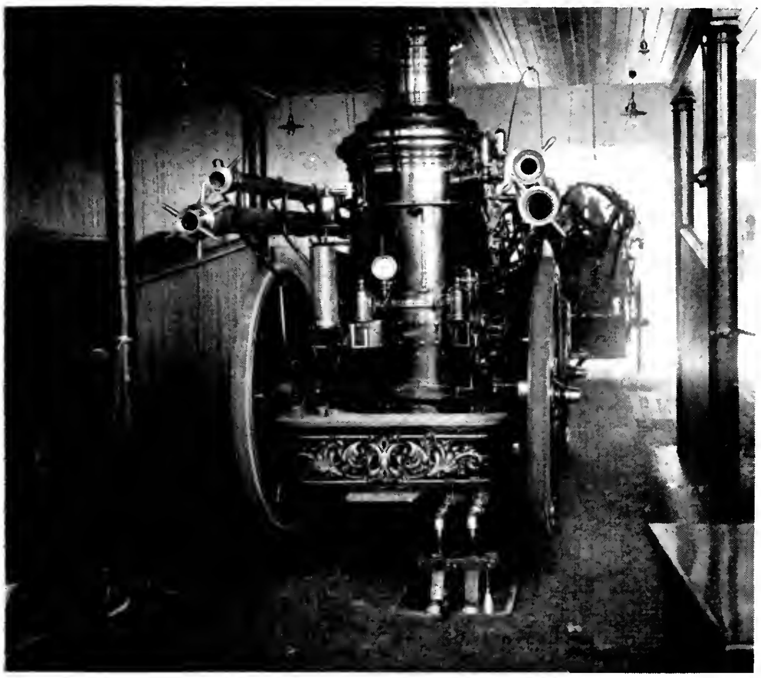
and remember, above all things, that by the successful manager the public cannot 'be damned.' "

An Irishman waiting for some information at the counter, was looking at the number of people paying their bills. After a moment or two he casually remarked, "Aint it wonderful during these hard times where all those people get the money the gas company takes away from them."

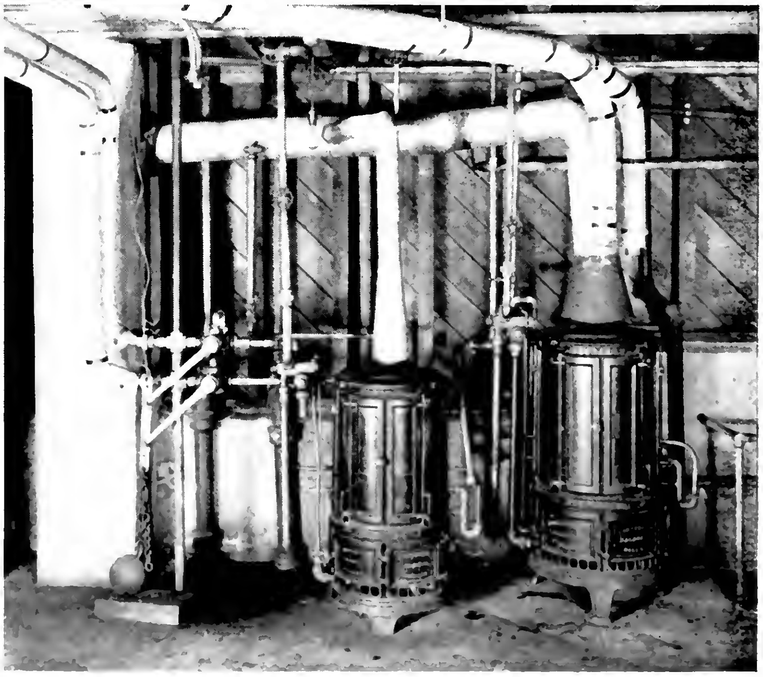
"I want me bill." "Name, please?" "Mrs. Caffey." "Where do you reside, Mrs. Caffey?" "Never mind me residence—I'm the only Mrs. Caffey in the parish."

"Waiting With Steam Up"

THE regulations of the Fire Department require that while an fire engine is in the engine-house awaiting an alarm of fire, steam be kept up in the boiler at a pressure of five pounds to the square inch. Then when an alarm is received, the fuel in the firebox is kindled as the apparatus leaves the house and the steam pressure rapidly rises. Since it would be neither convenient or economical to keep fuel burning in the firebox for the purpose first mentioned, it has long been the practice here, as elsewhere, to connect the boiler with a stationary heater in the basement of the house. Two pipes are installed between the boiler and the heater to provide for a circulation of the hot water contained in the system.



Projecting from the back of the engine there may be seen in the upper photograph the pipes which connect with others running through the floor to the heater beneath. The couplings just above the floor permit of instant connection or disconnection, while the self-acting valves prevent hot water escaping from either boiler or heater pipe when they are uncoupled.



The pipes re-appear at the extreme left of the lower photograph, and near the centre of the picture is the heater. This is of the familiar and time-tried gas type, which constantly maintains the conditions of temperature and pressure for which it has been adjusted, lighting and extinguishing the gas burner automatically and with no attendance whatever.

A heater of but small capacity is required, for when the engine returns from service at a fire, the boiler is not only hot but often under a pressure of fifty pounds or so, which must be "blown off" before it is connected to the stationary pipes.

Besides the freedom from ashes and dirt gained by the use of a gas heater, there has been shown

a slight but noticeable saving in the cost of the fuel. This installation is but one of the many novel uses to which the trustworthy and efficient gas water-heater has been adapted. The larger heater shown at the right of the picture furnishes hot water in abundance for general purposes in the men's quarters. The apparatus shown is at Engine House No. 31 of the San Francisco Fire Department, on Green Street, near Leavenworth. F. J. S.

Large De Laval Turbine in Sweden

Power and the Engineer, May 3, 1910; p. 798.

The Yngeredsfors power station at Varberg, Sweden, contains a 2,750 horsepower condensing De Laval turbine as a reserve to the water-power station. With water-tube boilers fitted with superheaters, the following operating results were obtained:

	NORMAL LOAD
Steam pressure in boilers, lb. per sq. in.	169.2
Superheat in boilers, deg. F.	212
Draft, in.	0.63
Coal per hour, lb.	3,839
Evaporation of water per lb. of coal, lb.	6.73
Feed water before heating, deg. F.	45.5
Steam pressure above the governor valve, lb. per sq. in.	167.2
Steam temperature above the governor valve, deg. F.	541.5
Superheat above the governor valve, lb. per sq. in.	157.6
Revolutions per minute (about)	1,500
Vacuum (reduced to 760) 94.92%	28.49"
Kilowatts	15.70
Steam per kw. hour, lb.	16.47
Coal per kw. hour, lb.	2.448
Generators degree of efficiency	0.94
Brake horsepower	2,238
Steam per brake hp, hour	11.64

At subsequent test, coal consumption of 1.98 pounds per kilowatt hour was obtained.

While the general public realizes that the company is at its service day and night, an inquiry as to whether we have a side door on Sunday may be considered a compliment of no small value.

Civilization Should Fight Fire as it Fights Disease

San Francisco Bulletin, Jan. 17, 1911.

That there should be a campaign against fire, just as there is a campaign against tuberculosis, is the opinion of Peter Joseph McKeon, one of the contributors to the current number of the Survey magazine. "Fire," he says, "is a disease which is epidemic in all buildings and which will yield only to the same treatment which has been successful in other diseases."

The point of this is, of course, that there should be a campaign of education along scientific lines. At present, as this author sets forth, what is everybody's business is nobody's business, and often the man who is clamorous in his denunciation of those responsible for the latest fire horror has a home that might well be called a death-trap.

After declaring that the same conditions which in a Newark factory building caused the death of many women and girls exist in many other buildings, Mr. McKeon says that the safeguarding of factories will be reached only when laws are based on sound principles of fire safety and take heed of what fire prevention science has already established as necessary precautions. This, he points out, means new standards of construction and a recognition of the variation of demands which changed occupancy, processes and populations make on structures. Even that is not all, for as Mr. McKeon well says:

"The application of the laws will also have to be made by competent inspectors; either special fire prevention inspectors will have to be employed or the regular inspectors will need instruction and training in fire prevention science. And responsibility for the enforcement of the law must be centered inescapably."

Such is the remedy for an eradicable disease that annually slays thousands of men, women and children. Why not apply it?

The Dawn of the Electrical Era

By M. VON SCHLICHTING, Bookkeeping Department, San Francisco Gas and Electric Co.

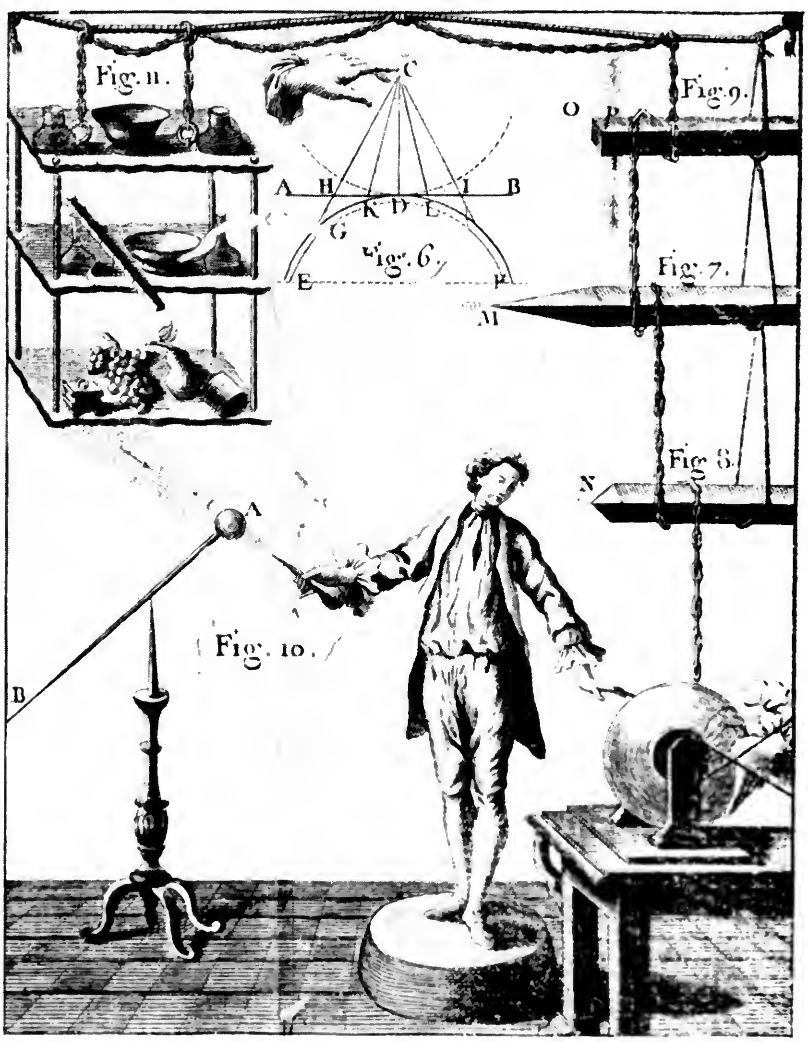
THAT electricity is a wonderful thing is granted by general consensus. Nevertheless, it is a fact that it has long since ceased to excite individual wonder, for the following simple reason. Being the most versatile and intelligent of all natural agents employed by mankind, it is pressed into service wherever white men dwell in a steadily increasing diversity of ingenious appliances which all have seen or heard of. So it is not the presence of electricity, but rather its absence that is likely to surprise the average man.

Nothing can excel or equal it in general usefulness, and its disappearance, if possible, would mean a world-wide calamity.

Considering its paramount importance in modern human economy, it is strange, and to my feeling at least, shocking to think that nature, the so-called mother of all creatures and things, never produced this marvelously protean kind of energy spontaneously in a mode that could have been directly utilized by men or could have served as a guiding hint at its unlimited possibilities. Truly, nature is not a mother that feeds us on her lap, but an envious monster, and so we invented science as a method to protect ourselves and make life bearable.

As the ancients were supplied with abundant slave labor, they took little interest in labor-saving devices. They had few machines, representing only the simplest mechanical principles, and science, which is our most valued ally in the struggle for life, was with them less a necessity than a pastime—less popular than art, athletics, metaphysics, rhetoric and other pleasant, although unproductive occupations of the cultured class.

The ancients had a fragmentary knowledge of the most conspicuous manifestations of static electricity; such as lighting, luminous terrestrial discharges, St. Elmo's fire and frictional electricity, the last one being first mentioned by the half legendary Thales of Miletus, said to have lived between 636 and 516 B. C. They also recorded the mysterious benumbing blows struck by the electric ray of the Mediterranean Sea (*Torpedo Marmora-*



tus) ; these various facts, however, were either interpreted in a superstitious manner, or not commented upon at all.

Among the relics left by the Egyptians, the Babylonians, the Assyrians, the Chinese and the Hindoos of antiquity, no traces of any knowledge of electricity have been discovered.

Electricity as a science, preparatory to its industrial application, is one of the many blessings that we owe to the Rennaissance.

Dr. Gilbert of Colchester (1540-1603) in his work "*De Magnete Magneticisque Corporibus*," created the term "electricity," deriving it very aptly from the Greek word for amber, as this fossil resin had been the first thing known to acquire peculiar properties by friction. He also ascertained by experiment that the same effect may be produced in almost any kind of solid by appropriate means.

Otto von Guericke of Magdeburg (1602-1666), of air-pump fame, constructed and exhibited the first electrical machine, consisting of a sulphur ball rotated and rubbed by the hand.

This was improved by others. Fruitful laboratory work was done and a pretty complete inventory of the simpler effects and phases of static electricity was taken. In 1745 the accidental invention of the so-called "Leyden jar" with its strange and powerful physiological effects, created an unprecedented sensation. Static electricity (as the only kind then known) became more than ever the favorite subject of the leading physicists as well as the object of universal curiosity and expectation.

One of the prominent scientists of that memorable period was the French academician, Father Jean Antoine Nollet. From his own treatise on the subject, published in 1754, "*Avec Approbation et privilege du Roi*," I take the three engravings inserted in this article, that are self-explanatory.

They show the distinguished scholar busied with different lines of tests and experiments, using such implements as were then available. Judged from up-to-date standards, his technical outfit appears deficient and clumsy, and his purpose hopeless and futile. This, however, would be an erroneous impression.

Nollet strengthened and exalted the scant means at his disposal by his brilliant personal qualities. We see him using the three indispensable elements of all electricity—a generator, conductors and insulators, in the primitive forms of a glass globe friction machine, plain iron chains and rods, silk cord and resin pads for insulation from the ground.

His keen, observing faculty, his penetration, unbiased mind, ardent ambition and untiring patience and trust are manifested in his book. It is full of valuable information, a model of scientific composition, and last, but not least, delightful reading on account of its elegance of diction and choice French.

For a more detailed abstract, consult article by the writer in the *Electrical Review* of January 5th, 1907. The dark hieroglyphics that mar some of the illustrations are the uncalled-for contribution of that unsatiable bibliophile, the larva of that tiny beetle "*Sitrodrepa panicea*," commonly called bookworm. The book quoted from is partly perforated in fancy designs, and several pages require the trained eye and the inductive habit of a biped expert bibliophile in order to decipher their full meaning.

In those pre-berzelian times, no sharp lines of demarcation separated the pantry from the laboratory—the cuts show this graphically. Nollet with his excellent judgment, paid much attention to the effects of electricity upon organic bodies. He found out, among other facts, that animals, when made conductors of electricity, lose weight by evaporation, and that plant growth is accelerated. This was but a corollary to that other law, also demonstrated and verified by him, that a flow of electric fluid (whatever that is) tends to carry liquids easily through such capillary tubes as

under ordinary circumstances would oppose much resistance to their passage.

Nollet says: "*Je ne pense pas que cela puisse aller jusqu' a' multiplier les forets et grossir les moissons.*"

(I do not think that this could be carried far enough to multiply our forests and to increase our crops.)

Not at his time, but the rediscovery of this application of electricity to the forcing of crops by Sir Oliver Lodge, and others, was heralded as an important progress in plant breeding a few decades ago. Absolute originality seems to be a rare jewel as the old saying goes: "*Nil novi sub sole.*"

After perambulating and describing the domain of electricity as far as it had become known, Nollet states that non-professional people were losing their former interest in electricity. These phenomena, they said, although very interesting to scientists, seemed hopelessly unproductive.

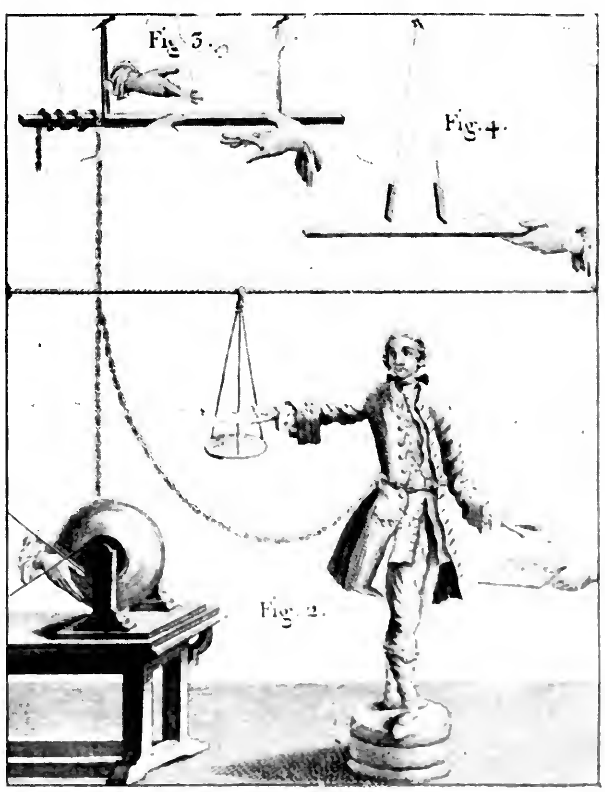
Then it was also that our Benjamin Franklin, being asked by one of those hypercritical outsiders (in modern slang called "wise guys"), the purport of the study of such trifles, replied: "Of what use is a baby? He may become a man!"

To the scientist worthy of the title, nothing seems trivial or meaningless. Unlike love's labor that is lost, many times, the honest effort in favor of exact knowledge or truth, as they used to call it, is never spent in vain. Every addition to existing knowledge, whether affirmative or negative, means an advance.

Science, indeed, is not a Marathon race; but a relay race, run by many in succession, where all the participants deserve equal credit. Charles Darwin expressed this idea beautifully when he wrote to the author of a book on Aristotle's contributions to modern science: "I never realized before reading your book to what an enormous summation of labour we owe even our common knowledge."

This exaggerated attention paid to seeming trifles during many centuries is just the thing that has differentiated the white man so markedly from his darker brothers and made him their boss.

The history of the development of elec-



tricity shows us also the saving power of a wholesome, unconquerable optimism. Like a flywheel it carried the physicists of the second half of the eighteenth century over the dead point of an apparent period of stagnation. They remind us of Moses unto whom the Lord spoke, saying:

"Get thee up into this mountain," Abarim unto Mount Nebo, "and behold the land of Canaan which I give unto the children of Israel for a possession . . . thou shalt see the land before thee, but thou shalt not go thither to the land which I give to the children of Israel." (Condensed from Deuteronomy XXXII, 48-52.)

These loyal workers never lost faith, just as Moses always trusted the Lord, and must have had equally comforting visions of grander things to follow their modest achievements.

A few sporadic attempts were made to find some practical use for electricity. I have before me a French transalation of a letter to the editor (published in the *Scot's Magazine* in February, 1753); the author signs his initials (C. M), and has been identified since as one Charles Morrison of Renfrew. He explains in full detail a very sensible system of electric telegraphy. This suggestion, as well as others of the same kind made afterwards, failed to become realities because the apparatus and the materials on hand were inadequate.

When the art of distilling alcohol had been invented, our European ancestors endorsed Lully's encomiastic term for this most questionable gift of alchemy and welcomed it as "*Aqua vitae ardens*," instead of calling it "*Aqua Mortis*," "*Gaudium Diaboli*," or anything else implying distrust and caution.

For identical reasons the hurtful shocks of the Leyden jar were taken for materia medica in disguise. In the wake of the primitive speculations and reckless theories of certain scientists, the very unscientific brotherhood of quacks got busy. This thing is mentioned in several old books I have seen. Even nowadays we see in the show-windows of our druggists electric belts, electropodes, and other devices that bear witness to two regrettable facts; First, that the very elements of one of the most fascinating branches of physicis are little known to the public at large; otherwise that line of goods would be unsable. Second, it proves that race suicide has proven powerless to check the proverbial high birth rate ascribed to the genus "sucker." But, to pile up more evidence in proof of so undisputed and notorious a fact, seems as superogatory as to carry smoke to Pittsburg, or, to illustrate it by domestic examples, to hire smart men or nice lady employees for the San Francisco Gas and Electric Company. (Thanks for the applause.)

Deeply impressed by the sanguine announcements of some responsible men who claimed to have performed quick or even instantaneous cures by the shock of the Leyden jar or by electrifying sealed tubes containing drugs, placed in the hands of the patients, Nollet arranged with the French Minister of War to try the healing experiment on some of the paralytic inmates of the Invalid's Home. He gives detailed reports, and concludes that his experiments were failures in all cases. As soon as he became aware that instead of removing or alleviating the afflictions of those unhappy veterans, he increased their sufferings, his sincere philanthropism caused him to desist, never to try again.

How the hidden virtue of electricity was brought to light in a most unexpected manner, will be shown in another article.

The Gas and Electric Appliance Co., of San Francisco report that they have an order from the Western Union Telegraph Company to equip all local and branch offices in San Francisco and Alameda Counties with gas-steam radiators

Lightning Causes Fire

SAN PEDRO, Cal., Jan. 31.—The first fire ever caused by lightning in this part of Southern California, where lightning itself is almost unprecedented, occurred early today during a heavy thunderstorm when the substation of the Southern California Edison Company, on Terminal Island, was struck by a bolt and completely destroyed by the blaze which followed. The loss is $6,000.

The gas bills for the population of London for the year just past, which does not include charges for meters or stoves, amounted to 5,476,594 pounds sterling. Taking the equivalent in money of the United States (exchange at $4.80) would give us $26,287,651.20. The expenditure on electricity supplied totaled 1,946,639 pounds sterling, and the equivalent in money of the United States at the same rate of exchange would be $9,343,867.20.

"Do you wish to pay your bill, sir?" was asked of a fine, big Irish lad, as he entered the office with his bill in his hand. He turned on the information man with, "*Do I wish to pay me bill?* Laddie, that's a fine bit of sarcasm! Say, if me wish was granted ye 'd all be where there ain't no bills for the fuel ye burn."

"He has achieved success who has lived well, laughed often and loved much; who has gained the respect of intelligent men and the love of little children; who has filled his niche and accomplished his task; who has left the world better than he found it, whether by an improved poppy, a perfect poem or a rescued soul; who has never lacked appreciation of earth's beauty or failed to express it; who has always looked for the best in others and given the best he had; whose life was an inspiration; whose memory is a benediction."

The New Solano Power Division

A departmental order issued by Mr. P. M. Downing, engineer, February 1st, 1911, creates a new power division to be known as the Solano Power Division, with Mr. J. W. Coons as Acting Superintendent.

The new division includes that portion of the system heretofore in Sacramento Power Division from the high tension Bay line crossings at Vernon to the town limits of Dixon; also the Sacramento-Davis line from the Lovdal Pumping Plant to Davis, the distributing line from Woodland to Knights Landing, together with all stations supplied from these lines. It also includes that portion of the system formerly in North Tower Power Division from the town limits of Dixon to Suisun, together with the branch lines running to Rio Vista and Cement, and the sub-stations supplied therefrom.

Mr. J. W. Coons, the Acting Superintendent of this new division, is a graduate of Stanford University, and has been with the company for a number of years. He was formerly a foreman in the Electric Construction Department, but more recently has been filling a similar position in the Operation and Maintenance Department.

Public Service Commission Law in South Carolina

Electrical World, May 5, 1910; p. 1117.

An act creating a public service commission has been passed by the 1910 General Assembly of South Carolina. The Commission has the power to fix and establish the rates and charges for the supply of water, gas, and electricity furnished by any person, firm or corporation, and to prescribe penalties in all cities in the State except Charleston, Marion, Spartanburg, Sumter, Union and Conway. Provision is made for a court review if the rates fixed are considered unjust and unreasonable.

Recreation at Lake Fordyce

By W. W. COOLEY, San Francisco Agent, Burroughs Adding Machine Co.

IN conversation with various employees of the P. C. and E. Co., I have been greatly surprised to find that many did not know of the grand and beautiful country that surrounds Lake Fordyce.

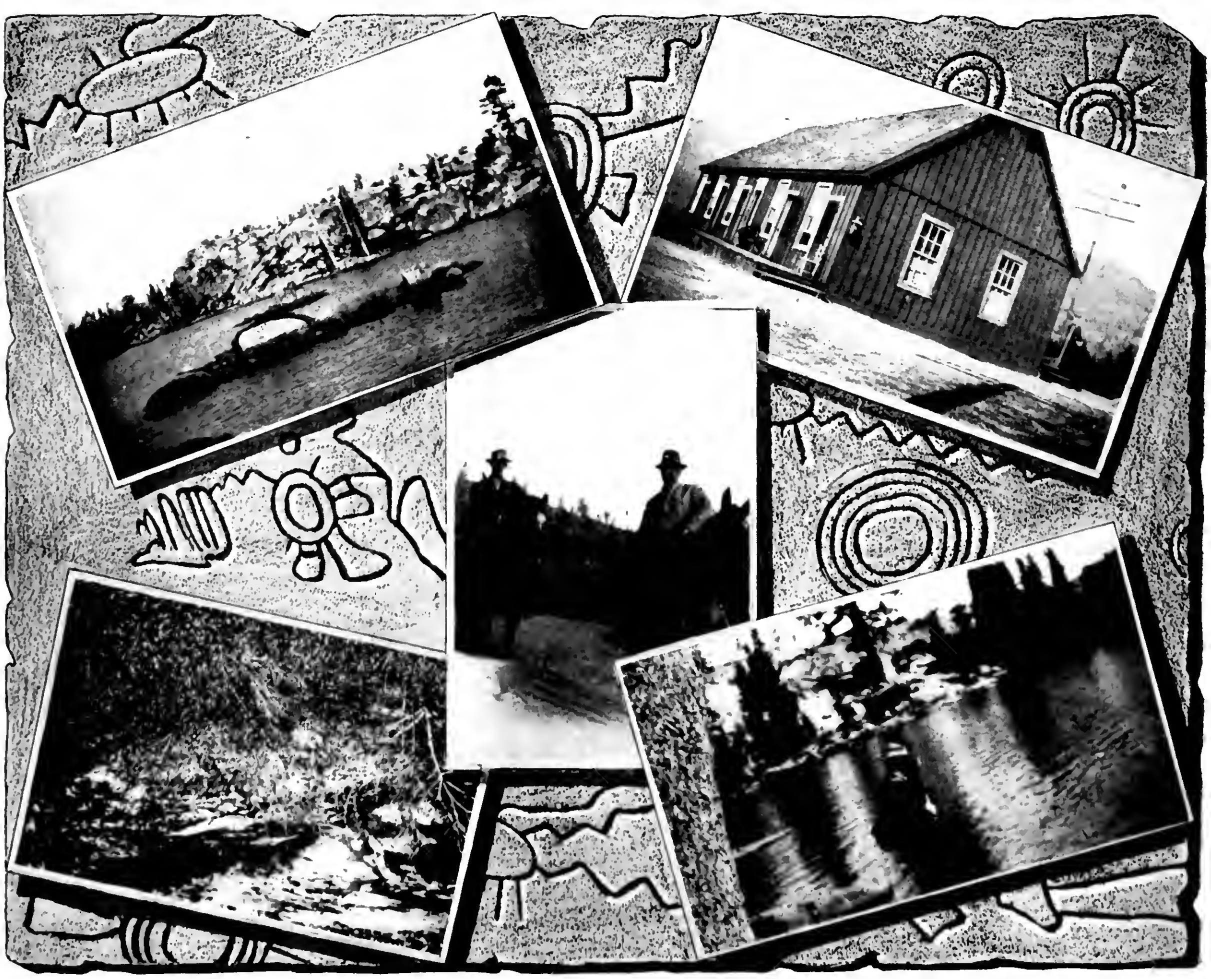
Lake Fordyce, nestling in the Sierras, 7,000 feet above the level of the sea, is most picturesque and should be visited by those who seek recreation at a reasonable expense.

To reach this pretty spot, take the train from San Francisco in the evening, arriving at Cisco in the early morn, and witness the sunrise in all its majestic surroundings of mountain peaks.

After breakfast, a horse or a good pair of legs will carry you over the mountain trail, a distance of about seven miles, to Lake Fordyce. Its beauty can be observed from the heights on the trail long before you reach the lake, but its magnificent splendor cannot be realized until you have journeyed about this large body of water that cuts such a figure in the power development of the company.

The two employees of the company, E. E. Roening and Gus Anderson who are stationed at the lake are most courteous and obliging in showing the stranger where the largest speckled beauties are to be hooked.

As the trout are always anxiously awaiting the arrival of the fisherman a mess is al-



The Hotel at Cisco in Winter.

ways insured while some who take pack animals with them find the animal useful to carry part of the catch.

After a days fishing comes the return trip to Cisco which brings us down the south slope, with western view, whereby we again witness the beautiful sunset amidst the distant mountains, a scene that is not soon forgotten.

After supper we take the train back to San Francisco where we arrive having only been absent one day from business.

This trip is one that is often taken for

The Hotel Stables—Railroad and Snow Sheds in the distance.

"a day's rest," but if your time permits, accommodations can be secured at the Cisco Hotel at $2.00 per day from where you can hike to numerous other lakes and streams.

To those who care for camp life we suggest that the banks of the Yuba River a short distance below Cisco offers splendid opportunity. Ship your outfit to Cisco, ordinary supplies can be had at "city prices." In seeking a place to spend a vacation of a day or month there are few places where one can enjoy himself more at so small an outlay as on the company's preserves in the vicinity of Lake Fordyce.

Fare, round trip	$7.80
Hotel, per day	2.00
Horse	2.00
Sleeper	1.50

Electric Talks

Application of the Magnet, Resistance and Conductivity.

By JOSEPH P. BALOUN, Head Draftsman.


Joseph P. Baloun

In the words of Thomas A. Edison, "between the metal arms of the simple magnet lies the power which drives all the trolley cars, all the electric motors and all the lighting plants of the world."

The first American to make application of magnets for the patenting and building of an electric motor was Thomas Davenport of Brandon, Vermont, and he was the first that applied electric power to railroads and printing presses. In July, 1834, Davenport built his first motor with two stationary and two revolving electro-magnets, the changes of polarity in the two sets causing attraction and repulsion and thus "producing a constant revolution of the wheel," as he described it when writing his patent for the "production of rotary motion by repeated changes of magnetic poles." This patent was granted Feb. 27th, 1837.

All materials of all bodies offer opposition or resistance to the flow of an electric current. In the same manner pipes offer opposition to the passage of water through them, due to friction. This resistance is very slight in some and of a very high degree in others.

The material producing a very slight resistance is a very good conductor and vice versa; for conductivity and resistance are reciprocals of one another, that is, if the one is increased the other is decreased in the same ratio. Thus a poor conductor is one with a high resistance and is selected when a medium such as one of an insulating nature is required. A poor conductor is called an insulator. All metals and alloys are good conductors, but no conducting medium possesses perfect conductivity. Some of the good conductors itemized according to their conductance value is as follows: Silver, copper, aluminum, zinc, brass, platinum, iron, nickel, tin, lead, German silver and mercury.

Fair conductors are listed as follows; charcoal, carbon, plumbago, acid solutions, salt water, vegetable substances and moist earth.

Poor conductors are listed as follows: water, the human body, fire flame, linen, cotton and marble; the following wood when dry: mahogany, pine and teak.

Non-conductors or insulators are listed as follows: slate, oils, porcelain, dry leather, dry paper, wool, silk, sealing wax, sulphur, gutta-percha, shellac, ebonite, mica, paraffine, glass and dry air.

There is a unit of measurement by which all resistance is measured. It is called an Ohm, named after the German scientist and electrician, George Simon Ohm, and is the resistance offered to a flow of electric current by a column of mercury 41.73 inches high and having a cross sectional area equal to .0015 square inches at 32° Fahrenheit.

This celebrated professor of physics formulated the law, known as Ohm's law, that, the current is directly proportional to the electro motive force, and inversely proportional to the resistance, thus the intensity of an electric current is equal to the electro-motive force divided by the resistance.

The unit of electro-motive force is called a volt, named after Count Allesandro Volta, a renowned Italian physicist and professor of natural philosophy.

As power is the rate at which energy is expended, we have by multiplying the current in amperes by the pressure, in volts causing it to flow, the electro-motive force, the unit of electrical power called a watt, named after the famous Scotchman, James Watt, a mechanician and scientist. This unit, watt, is very small, and kilowatt (usually abbreviated K. W. meaning a thousand watts) is most always used. Since 746 watts equal an electrical horsepower, a K.W. equals 1.34 horsepower.

If with a wire of a given resistance, a given pressure be applied a certain current will flow, or with the same voltage, and a wire of less resistance put in the circuit, a greater curent will flow. The relationship between current, electrical pressure and resistance are shown by the equation $I = \frac{E}{R}$, where I equals the current in amperes, E the pressure in volts, and R the resistance in Ohms.

Since the size of a wire or the cross sectional area of a conductor carrying electricity is directly proportional to the number of amperes carried, a small wire may be used for a very high voltage when transmitting a given power, providing the amperage is low. It is the application of this principle that enables us to carry out the installation of all high tension, long distance transmission of electricity, as is at present being constructed and operated from the Sierras to the cities on the coast. Thus by the use of metallic wires of sufficient size the necessary current is carried and by the use of proper insulation its direction of flow is confined to the localities desired. If the area of the conductor was small the passage of current would cause the generation of heat, if forced through by an electrical pressure. The amount of the heat generated is equal to the square of the current following, multiplied by the resistance.

It is notable that perfect insulation is sought as much as perfect conductivity.

Long distance transmission of electricity today is made possible through the very high grade of glazed porcelain insulators used for the support of the copper and aluminum conductors. It is apparent for commercial reasons that in any transmission system that the size, weight and cost of the copper conductor must be kept down and as the distance to transmit electricity increase, the voltage and not the wire dimensions must increase. This means that the insulation must be greatly increased over what it is today. Taking for example that 100,000 volts is the practical maximum voltage for long distance as applied today and fully realizing what the multiple disc type of the strain and supporting insula-

tors for this system are, we must readily grant that an enormous improvement of insulator manufacture would be necessary for ten times the above pressure or 1,000,000 volts which future conditions or generations might demand.

Resistance on the one hand when not desired is a disadvantage, but on the other hand, many of our electrical instruments and apparatus introduce for the sake of adjustment or calibration some sort of resistance, which is often made to alter automatically due to a change of load, current or pressure as desired. All of our electrical cooking utensils, heating equipment and even our ordinary carbon filament incandescent lamp or its new competitor the tungsten lamp are made to burn because a big pressure is back of the current to force it through a high resistance, and in the care of the lamps since energy is dissipated at the point of resistance in the form of heat, the filament as a consequence is brought to a very high temperature and a state of incandescence.

There are some simple numerical examples that illustrate the amount of resistance, an ohm, such as:

1 ohm=1,000 feet of No. 10 B..& S. copper wire.

1 ohm= 250 feet of No. 16 B. & S. copper wire.

1,000 feet of 0000 B. & S. copper wire= .049 ohm.

1,000 feet of 40 B. & S. copper wire= 1063 ohm.

The resistance of a conductor is directly proportional to its length, thus 2,000 feet of No. 10 B. & S. wire has a resistance of 2 ohms.

The resistance of a conductor is inversely proportional to its cross-sectional area; that is, a wire ¼-inch in diameter has 4 times the resistance of a wire ½-inch in diameter.

How Some Men Work

SITTING in a comfortable office, by a good gas log or electric heater, with the bright sun shining on the outside world, or treading your way through the streets of your cities, with possibly a drizzly rain falling, one should be thankful that the work which he is doing does not come within the character of the work which the men of the Company in the mountains are very often called upon to do.

The Consumer, who has water on tap at his faucets at every second of the day; who can push a button and have his house illuminated by electric lights, does not realize the arduous and hazardous work performed by many employees of the Company, in taking care of its property during the severe winter storms which prevail in the mountain sections.

As illustrative of the difficulties attendant upon giving service, both water and electric energy, in the high Sierras, on the systems of this Company, the following excerpts from a letter reporting details, by Geo. Scarfe of the Nevada Water District, may prove interesting:

"Confirming my telephone message of this morning, I am pleased to report that the main ditch from Bear Valley to Big Tunnel was finally opened on the evening of the 29th.

This ditch became blocked with snow on the 13th owing to a snow slide above Bear Valley, near the head of the ditch or flume under the bluff. This slide carried away six boxes.

"Owing to the continuing sliding of the snow at this point, making it unsafe to work, and owing to the great depth of snow, it was the 18th before water was again turned in. It required all the local men at that point to keep the flume in place, and we had to send men from Nevada City and Grass Valley to take up the work of cleaning the ditch. This was commenced on the 18th, as soon as water was available, and good progress was made until the 26th, when another severe snow storm retarded the work considerably.

"The actual working time on the ditch covered a period of ten days and nights. At no time was the work let up, men working day and night, sometimes 12 to 18 hours, without a let up. All the work had to be done on snow shoes in heavy snow storm and rain, and it has been, without doubt, one of the hardest fights the Company has ever had, but no breaks occurred in the flumes or ditches below Bear Valley, same being continually watched so that the water used for flushing the snow could not possibly get over the bank.

"On January 12th, a break occurred near the head of Cascade, on Deer Creek below the power house, caused by a tree going across the ditch during a heavy wind. This made it necessary to put in 80 feet of flume. Here, again, we had four or six feet of snow to contend with, the snow falling after the ditch was broken so that this part of the system was blocked practically from the head of the Cascade to Grass Valley. We had this finally opened during the night of January 20th, the water being out eight days. It was necessary during these eight days to curtail the supply of water to all of the mines to practically nothing, and by conserving what rain fell along the ditches we were able to maintain the domestic supply for the towns of Grass Valley and Nevada.

"On the Snow Mountain ditch, above Nevada City, an old mining tunnel below one of our flumes caved in, dropping the flume down on the night of the 12th; and we were 24 hours getting this replaced. This covers, in general, the conditions that have existed on this system since the 13th of the month to the present time.

"I want, at this time, to call your attention to the work performed by our agents who have been at the front night and day, working hard in the face of great discouragement, and I feel that it is right that they should be recognized."

A New Type of Vehicle Battery

The Electric Storage Battery Company, maker of the well-known Exide Battery, has developed a new type of vehicle battery, called the "Ironclad-Exide" type. A great difficulty with the standard vehicle battery has been the gradual falling off of the active material, necessitating occasional cleaning of the cells and reducing the life of the plates. In the new type, the active material is retained in place mechanically, so that this battery will have three times the life of the older types and will rarely, if ever, require cleaning.

A Swedish lady ran, rather than walked, to the counter, with an expression of triumph on her face, and made a speech something like this: "I gat you feller this time. I know someone he come blow up the mater every month, this month he forgot blow up mater; look at it, mine bill, last month five dollar, this month one dollar. He over-read mater last month? Yas, I know, and he forgot to come round this month. I don't care if he lose yob. I use only one dollar gas a month, even if you charge three dollar, if not what make the bill yump up and then yump down?"

MEN OF THE COMPANY

GEORGE SCARFE

SOME men are born to mechanics; some achieve it, and some have it thrust upon them. It is said that a man whose thumb bends backward is gifted with a mechanical turn of mind, and is able to do anything from building a water-wheel to inventing an air-ship.

Men of a mechanical turn of mind are needed very much in our rapidly growing industries, and our Universities are turning out too often men who can speak and read Greek, and who are saturated with the dead languages, or who can talk learnedly of what Anthony or Cleopatra might have done, or what effect it would have been upon the world had King James the First worn trousers instead of knee breeches, but what we want today in our busy world is a practical man who can tell us how to live better, and how to better enjoy the things we have, all of which is preliminary to a dissertation upon one George Scarfe. He, like his prototype, John Werry, without any option on his part, or without being consulted in the matter, so far as we are advised, was born in London, England, about the time that General Lee decided that it was unwise to further combat with the forces of Uncle Sam. He is, therefore, still a young man.

Being ambitious, as his subsequent life testifies to, and having the bent-over thumb, after absorbing all that the London Grammar Schools could furnish him with for absorption, he became a machinist's helper when but a lad, and pursued that employment until he saw in the development of electrical science an opportunity to utilize his mechanical knowledge, and in 1890 became the Engineer of the Electric Lighting Company in New York. Satisfactory inducements being offered, he associated himself with L. M. Hancock, formerly chief engineer of this Company, and in 1892 undertook the construction of an electric plant at San Miguel, San Salvador, Central America; subsequently accepting the position of Chief Engineer in the Eastern States, of the Towanda Electric Lighting Company, and as Construction Engineer of the Warren Electric Manufacturing Company. In 1900 he became associated with the Pacific Gas and Electric Company in its Nevada Division in charge

of the power plant at that point, and in 1904 became the manager of the South Yuba Water Company.

During the past ten years, he has shown a wonderful development of his mechanical abilities, not only in the immediate work of the Company, but as consulting engineer for the large gold mines operating in Nevada County. His ingenuity and particular skill has been principally shown in the development of the large plunger pumps used by the mines, in air compression work, and in steam engine development.

With all of this, he has also shown executive ability in the handling of men, particularly during the strenuous winter seasons in the high Sierras; untiring, energetic, and resourceful at all times in the advance and administration of the affairs of the Company which he represents.

To him any complicated machinery is but a toy, easily mastered under his able hands. He is also an omnivorous reader, delving into all branches of sciences, and with a very general knowledge of each.

By this it must not be understood that he is a handy man and Jack of all trades, but master of none, but on the contrary generally mastering all the trades that he has to do with.

He has some very pronounced notions upon aeronautics, and has built an airship, which undoubtedly will some time bring him fame. He still retains the ambition of his youth, and is not content to follow in any single rut.

Married in 1886, he is the proud father of five children, all of whom are displaying the traits of the father in the desire to acquire knowledge, and not hesitating at any work which will bring that knowledge, and not always through the easiest path. His oldest son, George O., is developing into an engineer of more than ordinary ability, and is now a Senior in the University of California.

George Scarfe is an example to the younger men of today who are striving to rise in their professions, as an example of what grit, energy, and ambition will at all times accomplish.

The Organization and Functions of a Sales Department

By Theodore J. Jones. *Electrical World*, June 2, 1910; p. 1467.

In the sales department of a central station company operating in a city of over 100,000 inhabitants, there should be the General Sales Agent and his staff; under him and answering directly to him we find the District Sales Agents, who have their solicitors; the Special Salesman, including those who look after city lighting and those who attend to the wiring of new buildings; the Appliance Manager, with demonstrator; the Power Engineer, with his Salesmen; and the Advertising Manager.

In connection with the work of the advertising manager, the writer urges the adoption of some city slogan in all publicity work, such for example as "Brighter Brooklyn," "Do it for Rochester," etc.

The writer also calls attention to the great desirability of coöperation with the city newspapers. For example, in the matter of an accident in an electric light plant, it would be a great advantage if the relations between the company and the newspapers were so cordial that a reporter would call the company's representative before publishing an account of the accident.

It is suggested that the Sales Department, through its salesmen, handle complaints, criticisms, etc. The General Sales Agent should know his largest customers, he should be known to the papers of the city and should assume the important function of identifying himself with the interests of the city which his company serves. As to coöperation, inter as well as intra departmental coöperation is equally important.

Pacific Gas and Electric Magazine

PUBLISHED IN THE INTEREST OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - - - - EDITOR
A. F. HOCKENBEAMER - - - BUSINESS MANAGER

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The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. II FEBRUARY, 1911 No. 9

EDITORIAL

WITH the same intrepid spirit which fought the fire of 1906, and on the ashes of the old city built up the newer one, and with the same feeling pervading the hearts of the men of San Francisco that pervaded them after 1906, our delegation of loyal men has convinced the Congress of the United States that our Pacific Coast was entitled to the Exposition of 1915, commemorating the completion of the most gigantic engineering scheme ever devised by men, and that our dear old San Francisco was the logical point at which to hold the same.

The debt of gratitude which we owe to those of our citizens who sacrificed personal interests and labored so assiduously and so well for the honor of San Francisco, can never be fully repaid; but we must not forget those at home, who, by words of encouragement and by well-directed and systematic efforts, helped those who were laboring at the Capitol to overcome a United South and to unite a Divided North and West into one solid mass; it was indeed a gigantic task, and one splendidly completed.

The effective team-work of the spirit of California suggests the possibility of the application of the same virility, intelligence, and forcefulness towards one end, that of the betterment of the physical, social, and material condition of Greater California, and the wiping out of all sectional differences, so that our great State may become a star of brilliancy in the crown of our great Union of States.

There is work, and much of it, yet ahead, for all Californians to make this coming Exposition one of startling individuality, imitating none other, but rather initiating and originating methods and means in carrying it to a successful end, not only artistically, but financially.

The records of the Exposition must be clean and wholesome; and it must be built upon strong business principles, so that at its close, each of those having to do with its success shall be able to say, that in its whole conduct, the errors and omissions of previous Expositions were not duplicated by them.

In the brief period of sixty years, an unpeopled domain has risen to the dimensions of an Empire, and no one is daring enough to prophesy the finality of California's greatness, but trusting to the same spirit which has brought this State and this city to its present established position, we can safely write now, the absolute and ultimate success of the Panama-Pacific Exposition of 1915.

Improvements in the System

The old Lowe generating set at Santa Rosa is being converted into a Jones type, with a view of increasing capacity.

The construction of garage building has been authorized for the accommodation of automobiles used in the Oakland District.

Extension of 11,000 volt line to the new pumping plant of the Alameda Beet Sugar Company has been completed. The pump is driven by a 150-horsepower motor.

Installation of 112 two-mantle gas posts is under way, pursuant to resolution passed by the Board of Public Works of Oakland.

A distributing system has been built to supply service at Town of Crow's Landing.

Richmond Substation is being reconstructed. A gallery will be installed which will contain the standard concrete compartments for installation of oil switches.

Electric runabout has been purchased for use of City Foreman of Distribution of Sacramento.

The erection of fourteen foot Jones Oil Set, capacity of two million feet per day, has been authorized for Sacramento.

Work on installation of low pressure main feeder at Fresno has been authorized at an approximate cost of $22,000.00.

Extension of 6,600 volt line from Winters to Pulah Creek has been made, to furnish service to the Sacramento Valley Sugar Co.

Extension of service to Peoples Water Company's pumping station at 40th and Diamond streets, Oakland, is now under way.

Installation of new oil tank at Colusa has been authorized.

Installation of washers known as the Ammonia Type have been authorized for Sacramento, Woodland, Vallejo and Marysville.

Station meters have been ordered for installation at the gas works, San Jose, Napa, Vallejo, Woodland, Colusa, Grass Valley and Marysville.

Property has been purchased adjoining Station "J" on the rear, in San Francisco, for the purpose of erecting thereon building for battery room.

Two three-unit motor generator sets have been ordered for installation at Mutual Station, and Station "G," San Francisco.

An electric wagon for use in Underground Dept., San Francisco, has been ordered.

A 150,000 foot storage holder has been authorized for Petaluma.

A 1,000 kilowatt motor generator set for Station "I," San Francisco, has been ordered.

Order has been placed for two 100-light, 1,100 volt, Arc Transformers for San Francisco substations.

An order has been placed for an automobile for use as an emergency car in the Electric Distribution Department, San Francisco.

By order of the Vice-President and General Manager, the following changes in the organization of the Pacific Gas and Electric Company will take effect on the respective dates mentioned.

Effective March 1, Mr. F. F. Barbour will assume the position of assistant to the President of the Pacific Gas and Electric Company, with direct supervision of all matters concerning the construction and operation of the street railway system of the Sacramento District, of the Stockton Water Company and supervision of the Commercial Department.

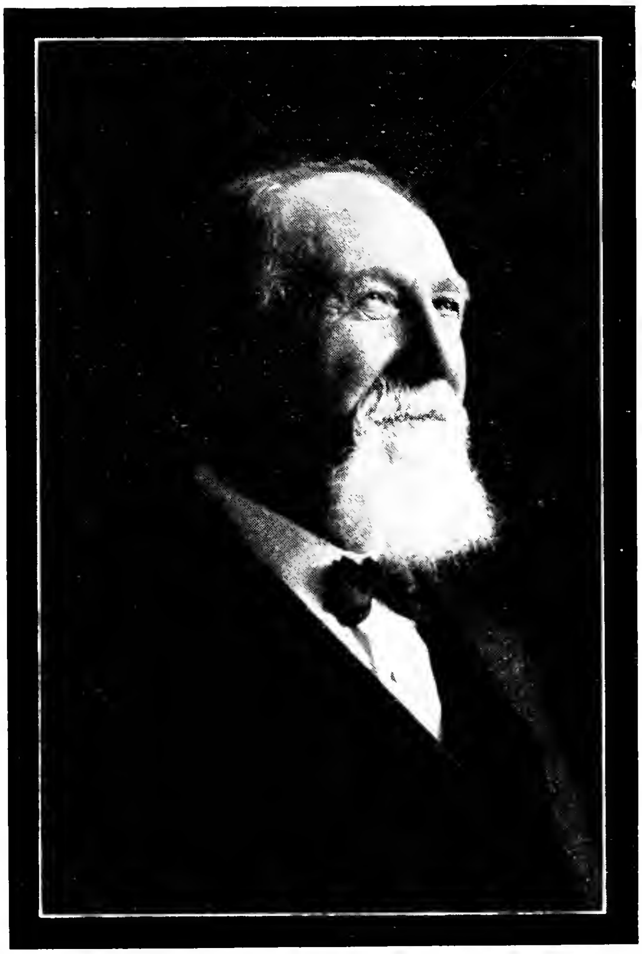
Mr. T. D. Petch, Manager of Santa Rosa, has resigned as of February 15th, 1911, and will be succeeded by Mr. M. G. Hall. Mr. Hall has been bookkeeper and in charge of the office of the Santa Rosa District for a number of years. He is favorably known throughout the entire district over which he will have charge, and we wish him success in his new position.

Mr. Geo. C. Holberton, now General Manager of the San Francisco Gas and Electric Company and Engineer of the Sacramento and Stockton Districts, will, subsequent to March 31st, 1911, devote his entire attention to the affairs of the San Francisco Gas and Electric Company.

Mr. F. E. Cronise, manager of the New Business Department, will, as of March 1st, become manager of the Contract Department of the San Francisco Gas and Electric Company, with Mr. F. S. Gray and Mr. D. A. White as assistants. Mr. Cronise will also retain supervision over the matter of obtaining new business in the Marin, Santa Rosa, Chico, Woodland, Fresno, Petaluma, Napa, Marysville, Colusa, and Redwood Districts.

IN MEMORIAM—RICHARD HALNAN

"His life was gentle, and the elements
So mix'd in him that Nature might stand up
And say to all the world, 'This was a man.' "



THERE died in Alameda on Sunday, February 5th, Richard Halnan, an employe of the Oakland Gas, Light and Heat Company.

To most of the readers of the magazine, Richard Halnan, or Dick, as he was familiarly called, was unknown, and yet with him there passed the type of the faithful servitor, who, during his whole life, had no other thought or feeling but that of loyalty to the Company by whom he was employed.

He began with the Oakland Gas Company in 1871, as a lighter of gas lamps. He was at that time a coachman for John Garber, the celebrated jurist. In 1874 he became permanently connected with the Oakland Company, in charge of its teams, and remained in that position until the time of his death.

With him days were not circumscribed by definite hours, but every hour of every day was his to give to his company. He took no part in political strifes or religious arguments. He was one of the State's best citizens, devoting himself to his family, to his friends and to his company; living a moral God-like life, which might be envied by many of those whose paths in life had led them to places of high eminence. He could not astound the world with eloquence of words, but could, and did, set an example by goodness of heart. Among the men with whom for so many years he was associated, genuine deep sorrow was apparent at the loss of one who had been a companion and friend and an advisor. He was of the kind that cheered the depressed spirit, visited the sick, and in his undiscovered and unhearlded acts of charity, carried out all of the perfections which were preached by the lowly Nazarene in his sermon on the Mount. Of the world's goods he had little, or none, yet he never knew poverty. His children were well clothed and well fed. Every day was one of brightness to him, and to those around him, and it was his boast, and a consolation to him in his last days, that in his long association with the Company, he had never been "on the carpet."

It would be well if, in this hurly burly life,—this strenuous struggle for the uppermost hand,—this world where all men wear spectacles and look at the world and men, not through the crystal glasses, but through the medium of the Almighty Dollar, if more men of his type could be born to do the good in the general way of humanity that he did.

Is Electricity Cheaper Than Oil?

From *Literary Digest.*

WHILE this may seem an idle question to those who have always regarded electricity as an expensive luxury, yet a good case for an affirmative answer is made out by *Popular Electricity* (Chicago, October) by calculating the cost on a basis of candle-power and taking into account effective distribution. Says this paper:

"Do you remember grandmother's kindly dictum? 'Better light the oil lamp, dear. It is cheaper.' There was reason for it, coming in the bygone years when everything electrical was much dearer than now and when even rough figuring showed that lighting by oil lamps was cheaper than by incandescents. Since that time the cost of current has steadily decreased, but thanks to the Standard Oil Company the price of oil has also gone down, so how do the two compare now?

"In grandmother's day the comparison was merely as to the amount of light obtained at the lamp at the same cost, for the use of reflecting and diffusing mediums was then practically unknown. Today all logical comparisons must be as to the effective lighting on tables, counters, desks, or in show-windows; in other words, what comparative illumination can be obtained from each illuminant for the same money?

"Theoretically, according to one of our leading authorities on illumination, Dr. Louis Bell, a gallon of the highest grade of kerosene burned in the most improved type of lamp will give 800 candle hours, which means that it will supply a 20 candle-power lamp for 40 hours. To obtain the same 20 candle-power in a tungsten lamp (requiring 25 watts) for the 40 hours would take 40 times 25 watt hours, or just a kilowatt hour. Therefore a gallon of the best kerosene can give theoretically as much light as a kilowatt hour of current. In practise the common grades of oil fall from 10 to 30 per cent shy of the best grades, so that it will take about 1¼ gallons of oil to equal a kilowatt-hour of current in the light obtained at the lamp."

But when it comes to effective light at the places where it is needed, the writer goes on to say, a 20-candle oil lamp is by no means equal to a 20-candle-power. incandescent. The large oil reservoir and chimney are in the way, and interfere with the effective use of reflectors. On the other hand, tungsten lamps may be used in any position, and by reflectors the useful illumination may easily be twice that from oil lamps of the same candle-power. In some classes of work such as show-window lighting, the proportion is as high as four to one. We read further:

"Allowing for the commercial kerosene, which is below the grade on which Dr. Bell bases his figures, this means that it will take anywhere from 2½ to 5 gallons of oil to give the same illumination as a kilowatt-hour of current. Thus at Chicago, where kerosene retails at 13 cents per gallon, oil lamps would be effectively as cheap as the incandescents if the current for different classes of indoor lighting costs from 32½ to 65 cents per kilowatt-hour, or an average of perhaps 40 cents. As a matter of fact it costs less than a third of this rate, so that even the much less efficient carbon filament lamps figure out cheaper in service than kerosene lamps.

"Besides, the incandescent lamps can be instantly turned on and off, thus saving wasteful times of burning, and they do not have the other annoying feature of the kerosene lamp; the labor of cleaning and filling lamps, the difficulty of keeping them from smoking if exposed to drafts, the fire risk in lighting them, the vitiation of the air both by the smell or fumes and by consuming oxygen, or the much greater radiation of heat (for what is the ordinary oil stove but an overgrown kerosene lamp?). If the lighting costs were equal, these objections would count seriously against the kerosene lamp, but with our modern high-efficiency incandescent lamps we have so far outstripped the oil in economy of operation that we can simply disregard its handicaps and look upon it merely as an interesting, but now outgrown factor in the historical development of illuminants."

PERSONALS

C. C. Crickelais, one of the operators at Martin Station, was recently married to Miss McGray, daughter of one of the well-known merchants of Jackson, Cal.

Mr. and Mrs. Earl A. Brown are the proud parents of a fine baby boy. Father Brown is employed at Martin Station.

Departmental Order E. D. 7 reports the appointment, effective February 1st, of A. U. Brandt as Superintendent of Electric Distribution in charge of the Overhead Department of Oakland and Alameda County Districts. The same order reports the appointment of R. C. Powell as Superintendent of Electric Distribution in charge of the Underground Department of Oakland District.

A daughter was born to Mr. and Mrs. J. W. Dooley, foreman of de Sabla Power House, on the 19th of January.

In Chico on New Years eve Miss Margaret Satterlee of that city became the bride of Mr. W. H. Bonham, an acting first operator of de Sabla Power House. After a short honeymoon spent in San Francisco the couple returned to de Sabla, which will be their home, and were given a jolly reception as well as a very handsome carving set by the boys at the Power House.

Mr. Lee I. Spangler, foreman of Centerville Power House, was called East on January 5th on account of the serious illness of his father, whose home is in Walnut, Iowa. During his absence Mr. Garret Keppel, a first operator at de Sabla Power House, has been appointed acting foreman of the Centerville Power House.

Up to 5 p. m. January 29th the rain gauge at the office of the de Sabla Power Division at Camp One records 24.66 inches precipitation. This fell since the 11th, the greatest precipitation in any 24 hours being on the 24th, when 5.28 inches fell.

The members of the Gaselco Club and their friends were treated to an illustrated lecture delivered by John A. Britton in the Assembly Room of the Company's building on Friday evening, January 20th. His subject comprised a description of the Pacific Gas and Electric Company's thirty-two plants, which serve two-thirds of California's population in twenty-six counties with two of its most needful commodities. The lecture was illustrated with a number of attractive stereopticon views, showing the activity that prevails at the various stations.

Probably the most interesting of the exhibits was the great Power Plant at Electra, where 26,666 electrical horsepower is generated. The speaker followed the different plants by successive stages on a reproduction of the huge map, which now graces the side of the Company's building, and in this way his hearers were made more intimately acquainted with the workings of the Power Division. In fact, the lecturer's thorough knowledge of the subject and the interesting manner in which it was presented proved a revelation to all who had the good fortune to hear him.

The speaker told of the beautiful mountain scenery in and about Electra, which he said was surpassed nowhere in the State. He created considerable enthusiasm when he extended a cordial invitation to all the employees to partake of the Company's hos-

pitality when taking their annual vacations. With horseback riding at Electra and fishing from a steam launch on beautiful Lake Fordyce, an enjoyable time was promised to everybody. So well was the invitation received that Joseph D. Butler, who is already training for the annual baseball game, decided to put on an extra voltage in his daily exercise with a view to walking to Electra and back, and then some.

Previous to the lecture the Gaselco Club held its regular meeting with President D. A. White in the chair, and Frank E. Oldis, Secretary. Engrossed resolutions of respect to the memory of the late Joseph J. Walsh, former head of the Collection Department, were unanimously adopted and ordered forwarded to his bereaved family.

E. A. Beauce.

When Oldis and Brearty Chased the Duck

There was a great commotion
In Gasville, so they say,
When Brearty and Oldis
Went shooting *Ducks* one day.

Frank journeyed to Sobrante,
While Charley went to Reeds,
They shot from morn till evening
But accomplished no great deeds.

They waded in the marshes,
Got wet as any rag,
And each of them expected
To bring home a limit bag.

Says Oldis, "Oh, I 've got one!"
His heart was full of joy;
He shot ten times and missed it,
Then found 't was a decoy.

Says Brearty, most disgusted,
For he, too, had hard luck,
"I 'd rather chase the growler
Any day than chase a duck."

Well, the shooting 'fest' was ended,
Believe me, 't was no pipe,
For all each had to show for it
Was a five-cent Key West SNIPE.

E. A. B.

Mr. F. H. Varney, Engineer of the O. and M. Department, Steam Section, left San Francisco February 11th for an extended trip throughout the East and will be gone about six weeks. Mr. Varney's itinerary takes in Chicago, New York, Pittsburg, Washington, Boston, and a visit to all the large electrical and steam engine plants adjacent to the above cities.

The United States Transport "Thomas," in the transport service between San Francisco and Manila, is at present in dry dock at the yards of the Moore & Scott Iron Works, Oakland, being treated with a coat of Biturine solution and enamel, as a preservative against rust to decks, bilgers, tanks, and in fact all exposed iron and steel construction.

The New Office of the Gas Company

From the *San Mateo Leader*, February 2, 1911.

Just next door to the National Bank's new quarters in the Coleman Building, with the bank fixtures from the bank's old quarters, and with gold letters on their windows, Superintendent Newbert, Cashier Walter L. Johnstone, and Assistant Cashier Geo. Munroe, of the United Gas and Electric Company, feel quite swell, and when you come in to see them now they say, "How do you do?" Before, in their old office on Second Avenue, they just said "Hello."

Yesterday a gentleman called in the office and asked Mr. Johnstone which was the paying window. "We have none," was his reply. "They are both receiving windows; we don't pay anything here, we just receive."

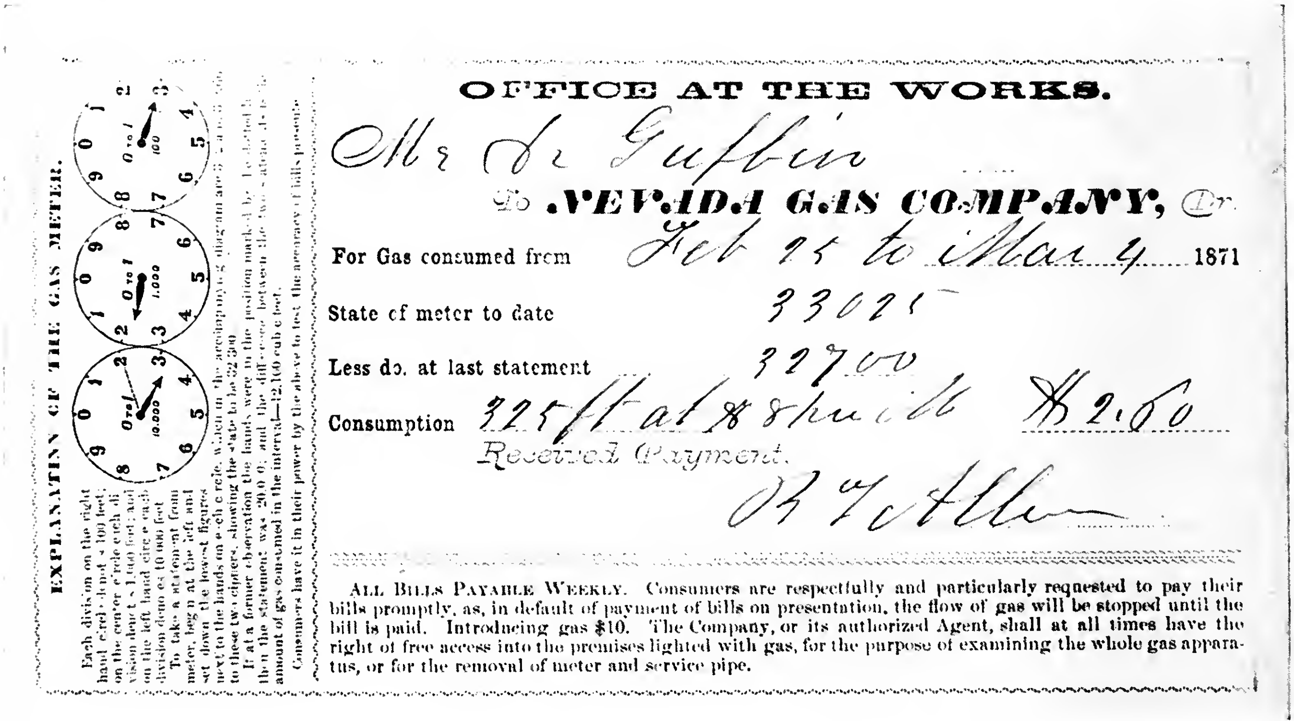
Do n't criticise others. If you knew what they said about *you*, you would offer to arbitrate.

Quoted from Register of Nevada Gas Company

August 17th, 1861.

Rules and Regulations Nevada Gas Company

We, the consumers of gas from the "Nevada Gas Company," agree and hold ourselves responsible for all gas consumed in our premises, as per register of meter, or otherwise agreed upon, and in case of leakage, or pipes becoming out of repair, to notify said company of such derangement. The company, or its authorized agent shall, at all times, have the right of free access into our premises lighted with gas, for the purpose of examining the whole gas apparatus, or for the removal of the meter and connections."



EXPLANATION OF THE GAS METER.

Each division on the right hand circle denotes 100 feet; on the center circle each division denotes 1,000 feet; and on the left hand circle each division denotes 10,000 feet.

To take a statement from meter, begin at the left and set down the lowest figures next to the hands on each circle, which in the accompanying diagram are 3, 2 and 3; add to these two ciphers, showing the state to be 32,300.

If at a former observation the hands were in the position marked by the dotted lines, then the statement was 20,000; and the difference between the two statements denotes the amount of gas consumed in the interval—12,300 cubic feet.

Consumers have it in their power by the above to test the accuracy of bills presented.

OFFICE AT THE WORKS.

Mr. S. Guffin

To NEVADA GAS COMPANY, Dr.

For Gas consumed from Feb 25 to May 4 1871

State of meter to date 33025

Less do. at last statement 32700

Consumption 325 ft at $8 per thousand $2.60

Received Payment.

R. T. Allen

All Bills Payable Weekly. Consumers are respectfully and particularly requested to pay their bills promptly, as, in default of payment of bills on presentation, the flow of gas will be stopped until the bill is paid. Introducing gas $10. The Company, or its authorized Agent, shall at all times have the right of free access into the premises lighted with gas, for the purpose of examining the whole gas apparatus, or for the removal of meter and service pipe.

What We Need Most

Men who put character above wealth.

Men who possess opinions and a will.

Men who will not lose their individuality in a crowd.

Men who will not think anything profitable that is dishonest.

Men who will be honest in small things as well as great things.

Men who will make no compromise with questionable things.

Men whose ambitions are not confined to their own selfish desires.

Men who will not have one brand of honesty for business purposes and another for private life.—*The Broadside.*

Employers' Liability Commission

Electrical World, April 7, 1910.

The Illinois Legislature has passed an act creating an employers' liability commission of twelve members to be appointed by the governor, and to consist of six employers of labor and six who represent the interests of the workmen. The commission is to investigate industrial accidents and to inquire into the most effectual method of providing for compensation for injuries or death due to such accidents. The compensation of the commissioners is fixed at the rate of $3 per day while actually engaged on the work of the commission, and the commissioners are to be reimbursed for all actual expenses incurred.

Even Corporations Have Souls

The following clipping from the *Colusa Sun*, and one from the *Sacramento News*, seem to be indicative of a change in the attitude towards public service corporations, as indicating appreciation of attempts made to serve the public courteously:

Colusa Sun, February 4.

There is a great comfort and pleasure, as well as a usefulness in the conditions with which the Gas and Electric Company has surrounded us. This long wet spell has demonstrated their worth to us this time doubly. That they have a more perfect system we know, for it has rained and flooded the country more than it has done for years, and the power has withstood it all. Our conveniences have been served steadily, for not a single time during all the rain-fall days have we been without power or light, except for a moment. The steadiness of the supply shows the system has been improved until it has become almost perfect. It shows, too, that it has been strengthened, to a considerable extent, for we all remember in the not distant past how the lights would be gone, and the power taken away in the midst of the busy hours, and how it would remain off for days at a time. But now that seems to have passed away, and the grateful residents of the valley appreciate the situation.

Sacramento News, January 28.

If your electric light doesn't burn as brightly as you think it should, it may not be the fault of the company; it may be because someone in your transmission district is stealing power that should rightly belong to you. It is to correct this evil and to establish an equitable rate for the charge of electricity throughout the city that George F. Walsh, honorary member of the Executive Committee of the Retail Merchants' Association, is conducting an exhaustive inquiry into electric rates in sixty different cities in the United States. His work will undoubtedly result in a revision of the charges made in this city, so as to place all consumers on an equitable basis.

In conversation with a representative of *The News* concerning his investigation, Mr. Walsh said:

"The Retail Merchants' Association has taken up the matter of charges for electricity and finds that there are abuses on both sides. The company is sometimes at fault; so is the consumer. Our aim is to bring about a rate that will be reasonable to the consumer and at the same time will give the company protection against common abuses.

"Our investigation has been welcomed by the company and they have cheerfully furnished us with information, realizing that it is to be benefited. One of the abuses that the company suffers is the theft of electricity by consumers. The city is divided into transmission districts. Enough electricity is furnished to each district to supply full power to all the lights in the district. When a consumer burns a 32-candle power light when he is only paying for a 16, or when he runs an electric heater that the company knows nothing about, he is taking that much power from the other consumers of the district. In a district where there are a great many electric heaters not being paid for, the power for lighting is weakened, and the company is blamed when it is probably not at fault. When my lights burn red, as they often do, it may not be that the company is not supplying the electricity, but because somebody is getting the power that I am paying for.

"We want to correct this and also to establish a fair rate. We want all put on an equitable basis and all rebates and special privileges abolished. We have obtained the rates charged in sixty American cities. These include cities that generate their electricity by steam and those that have the power brought over transmission lines from a distance.

"We believe we will succeed in establishing a new rate in Sacramento that will be seven-twelfths that charged in the city of Boston."

The Retail Merchants' Association has also carried on an investigation of the telephone rates and is preparing a schedule of charges to be presented to the company. This schedule is being drawn up after a comparison of charges in many cities. If the company adopts the schedule, and the retailers believe it will, it will mean the restoration of the old rate of $1.50 for telephones in residences.

QUESTION BOX

Question.—How can the disagreeable odor, due to improper combustion of gas in the use of Bunsen Burners upon gas ranges, water heaters and grates, be eliminated?

Answer.—The odor sometimes noticed in the use of gas appliances is generally due to the improper combustion of gas, owing to an insufficient air supply. This may be easily remedied by regulating the air mixer, which is a part of each Bunsen Burner. The odor is also sometimes caused by the use of too much gas and the impinging of the long gas flames on the bottom of cooking utensils. This retards the combustion of the gas, and some of the partially consumed gas is set free as acetylene. This has a characteristic garlic odor. The remedy is to shorten the gas flames by turning down the gas at the regulating valve. Often times the odor complained of is directly due to kitchen uncleanliness, or the accumulation of fats and food juices on the tops of stoves, and on the burners themselves. This last is probably most often the cause. of odor and the remedy is the frequent use of strong alkali in hot water for cleaning the parts of the stove.

Question.—How does it sometimes occur that although one (elec.) lamp of a series goes out while all are burning that the others continue to burn?

Answer.—Arc lamps or incandescent series lamps are equipped with automatic cutout devices whereby when the lamp burns out the circuit is not interrupted. In arc lamps this is done by means of a magnet, but in series incandescent lamps the same effect is accomplished by having a thin disc of copper which is automatically punctured by the current when the lamp burns out.

Question—Why are some transmission lines constructed with a grounded wire above the power wires?

Answer—This only occurs in one instance in California to my knowledge—in the case of the Great Western Power Company, where a steel messenger is fastened rigidly to the top of the tower over the entire length of transmission line. Its principal purpose is to act as a support to the tower in case of failure in the transmission line.

Question—What saving is effected by the use of tungsten lamps instead of carbon filament lamps, all things being equal?

Answer—A carbon lamp consumes 3½ watts per candle-power; metallic filament lamp, called the "Gem," consumes 2½ watts per candle-power; the tungsten lamp consumes 1¼ watts per candle-power. The life of the carbon and "Gem" lamp is from 400 to 600 hours, that of the tungsten lamp, under good conditions, averages 800 hours; however, as the tungsten lamp is more fragile and very often handled carelessly, it is difficult to state the saving effected by using tungsten lamps on account of the uncertain elements of renewals. The tungsten lamps cost, 16 c. p. size, about four times as much as the carbon or "Gem" lamp.

Question—Why are the large insulators made of porcelain and not of glass?

Answer—Mostly on account of mechanical strength. Also because glass being more hygroscopic, a larger insulator is required—too large for high voltages.

Question—Does a shell-type, three-phase transformer possess any advantages not possessed by a core-type transformer?

Answer—The shell-type three-phase transformer has the same reserve capacity as three single-phase transformers when connected delta-to-delta, since substantially two-thirds of the energy can be transmitted by two of the cores when the third phase has been damaged and short-circuited. In that case, the winding of the damaged phase is short-circuited upon itself and disconnected from the other. The core type transformer has not this advantage, but enables the use of a star-to-star connection, at least for moderate voltage.

PACIFIC GAS AND ELECTRIC COMPANY

DIRECTORS

F. B. Anderson
Henry E. Bothin
John A. Britton
W. H. Crocker
E. J. De Sabla, Jr.
F. G. Drum
John S. Drum
D. H. Foote
A. F. Hockenbeamer
John Martin
Louis Monteagle
Cyrus Pierce
Leon Sloss
Joseph S. Tobin
George K. Weeks

OFFICERS

F. G. Drum........President
John A. Britton........Vice-Pres. and Gen. Mgr.
A. F. Hockenbeamer.....2d Vice-Pres., Treas. and Comp.
D. H. Foote........Secretary
Charles L. Barrett........Asst. Secretary
W. R. Eckart........Consulting Engineer

HEADS OF DEPARTMENTS

W. H. Kline........General Agent
R. J. Cantrell........Property Agent
George C. Robb........Supt. of Supplies
J. H. Hunt........Purchasing Agent
E. B. Henley........Manager Land Dept.
J. P. Coghlan........Manager Claims Dept.
S. V. Walton........Manager Commercial Dept.
F. E. Cronise........Manager New-Business Dept.
H. Bostwick........Secretary to President
J. C. Love........Auditor
W. B. Bosley........Attorney
George C. Holberton..Engr. & Gen. Mgr. S. F. G & E. Co.
S. J. Lisberger........Engr. Electric Distribution
C. J. Wilson........Asst. Engr. Electric Distribution
H. C. Vensano........Civil Engineer
H. P. Pitts........Industrial Engineer
E. C. Jones........Engr. Gas Dept.
Sherwood Grover........Asst. Engr. Gas Department
C. F. Adams........Engr. of Electric Construction
P. M. Downing........Engr. O. & M. Hyd.-Elec. Sect.
F. H. Varney........Engr. O. & M. Steam & Gas Eng. Sect.

DISTRICT MANAGERS

Alameda County........F. A. Leach, Jr.
Berkeley........F. A. Leach, Jr.
Chico........H. B. Heryford
Colusa........W. M. Henderson
Dixon........C. E. Sedgwick
Fresno........E. W. Florence
Grass Valley........John Werry
Martinez........Joseph Mayo
Marysville........J. E. Poingdestre
Napa........O. E. Clark
Nevada City........John Werry
Newman........W. A. Widenmann
Oakland........F. A. Leach, Jr.
Petaluma........H. Weber
Redwood City........L. H. Newbert
Sacramento........C. W. McKillip
San Jose........J. D. Kuster
San Rafael........W. H. Foster
Santa Rosa........M. G. Hall
Vallejo........A. J. Stephens
Woodland........W. E. Osborn

MANAGERS OF WATER DISTRICTS

Colfax (Alta)........Jas. Martin
Nevada (Nevada City)........George Scarfe
Placer County (East Auburn)........H. M. Cooper
Standard (Electra)........W. E. Eskew
Stockton (Stockton)........J. W. Hall

SUPERINTENDENTS OF POWER DIVISIONS

Colgate........Joseph Mini
De Sabla........I. B. Adams
Electra........W. E. Eskew
Marysville........C. E. Young
Nevada City........George Scarfe
North Tower........C. D. Clark
Oakland........William Hughes
Sacramento........J. O. Tobey
San Jose........J. O. Hansen
South Tower........A. H. Burnett
Stockton........E. C. Monahan
Solano........J.W. Coons, Acting

SUPERINTENDENTS OF ELECTRIC DISTRIBUTION

Berkeley........J. H. Pape
Oakland (Underground)........R. C. Powell
Sacramento........C. R. Gill
San Jose........A. C. Ramsted
San Francisco........A. R. Thompson
Oakland and Alameda (Overhead)........A. H. Brandt

SUPERINTENDENTS OF GAS WORKS

Martin Station........John Mitchell
Oakland........A. C. Beck
Sacramento........Edward S. Jones
San Francisco........Dennis J. Lucey
San Jose........R. H. Hargreaves

SUPERINTENDENTS OF GAS DISTRIBUTION

Oakland........George Kirk
San Francisco........W. R. Morgan

The Pacific Gas and Electric Company

SUPPLIES

LIGHT, HEAT, AND POWER

TO

Place.	Population.
Agua Caliente	50
*Alameda	23,383
**Albany	800
‡Alta	200
Alvarado	200
Amador	200
Antioch	3,000
‡Auburn	2,050
Barber	200
**Belmont	600
Belvedere	350
Benicia	2,500
**Berkeley	40,434
Big Oak Flat	150
Biggs	750
Black Diamond	500
Brentwood	200
Brighton	100
Broderick	500
‡Brown's Valley	50
**Burlingame	5,000
Byron	200
Campbell	1,000
Cement	1,500
‡Centerville	20
Centerville	500
**Chico	13,000
**Colusa	2,700
‡Colfax	400
Colma	500
Concord	1,500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Davenport	1,000
Davis	750
Decoto	350
Dixon	1,000
Dobbins	50
Drytown	100
Durham	500
‡Dutch Flat	400
**Easton	500
**East San Jose	1,500
Eckley	20
Emerald	50
Elmhurst	2,500
Elmira	150
El Verano	100
**Emeryville	2,000
Encinal	20
Fairfield	800

Place.	Population.
**Fair Oaks	250
Fitchburg	250
Folsom	1,500
*Fresno	35,000
Glenn Ellen	500
Gold Run	100
Grafton	350
†Grass Valley	7,000
Gridley	1,800
Groveland	50
Hammonton	500
Hayward	4,000
Hollister	3,000
Ione	900
Irvington	1,000
Jackson	2,000
Jackson Gate	50
Larkspur	950
Lawrence	100
Kennedy Flat	50
Kentfield	200
‡Lincoln	1,500
‡Live Oak	200
Livermore	2,250
‡Loomis	150
Los Altos	200
Los Gatos	3,000
Mare Island	500
Martell	25
Martinez	5,000
**Marysville	6,250
Mayfield	1,500
**Menlo Park	1,500
Meridian	300
**Milbrae	300
Mill Valley	4,500
Mission San Jose	500
Mokelumne Hill	150
Mountain View	2,500
**Napa	6,000
†Nevada City	4,000
Newark	700
‡Newcastle	600
New Chicago	25
Newman	1,000
Niles	800
**Oakland	150,174
Oroville	2,500
Orwood	50
Pacheco	200
**Palo Alto	6,000
‡Penryn	250
Perkins	200
**Petaluma	6,000

Place.	Population.
Peyton	250
**Piedmont	2,000
Pinole	1,500
Pleasanton	2,000
Port Costa	600
**Redwood City	3,500
Richmond	10,000
Rio Vista	200
‡Rocklin	1,050
Rodeo	100
‡Roseville	345
Ross	900
***Sacramento	52,000
San Andreas	200
San Anselmo	2,500
San Bruno	1,500
San Carlos	100
**San Francisco	416,912
**San Jose	40,000
San Leandro	4,000
San Lorenzo	100
**San Mateo	7,000
San Pablo	1,000
**San Quentin Prison	1,600
**San Rafael	6,000
Santa Clara	8,000
Santa Cruz	10,000
**Santa Rosa	8,000
Saratoga	200
Sausalito	3,000
Sebastopol	2,000
Selby	100
Sonoma	1,200
South San Francisco	2,500
Stanford University	2,000
Stege	100
‡Stockton	25,000
Suisun	1,200
Sunnyvale	2,000
Sutter Creek	2,000
Tiburon	100
Tormey	150
‡Towle	200
Tracy	1,200
Vacaville	2,500
**Vallejo	12,000
Vallejo Junction	10
Walnut Creek	350
Warm Springs	200
Wheatland	1,400
Winters	1,200
**Woodland	3,500
Yolo	350
**Yuba City	1,900

*Gas only; **gas and electricity; †electricity, gas, and water; ‡electricity and water; ***gas, electricity, and street-car service; unmarked, electricity only.

Service Furnished	Number of Towns	Total Population
Electricity	158	1,089,790
Gas	33	988,900
Water	17	43,415
Street-Car	1	52,000

EMPLOYS 3,500 people
OPERATES 11 hydro-electric plants in the mountains
3 steam-driven electric plants in big cities
18 gas works

SERVES ⅔ of California's population
26 of California's 56 counties
An area of 32,431 square miles
⅗ the size of New York state
½ the size of all the New England states combined

Pacific Gas and Electric Magazine

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Frank B. Anderson

PRESIDENT, THE BANK OF CALIFORNIA—NATIONAL ASSOCIATION

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Down-stream Face of the Bear River Dam

The Bear River Reservoir of the Electra Power Division

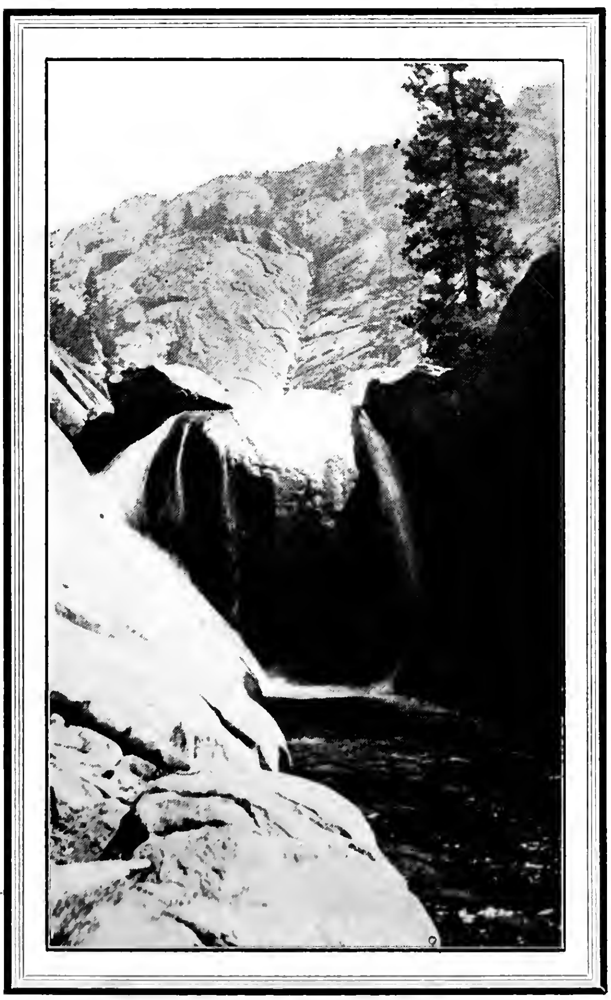
By WILL T. JONES, O. & M. Department.

NESTLED in the high Sierra Nevada mountains, in the eastern part of Amador County, 6,000 feet above the level of the sea, and surrounded by massive walls of superb granite, lies the Bear River reservoir or lake, which is one of the places in which water is stored during the spring of each year, to be used in the operation of the Electra power house during the late summer months and for furnishing water for the mines and for domestic and irrigating purposes in Amador County.

The Standard Electric Company realizing the necessity of ample storage to tide them over the dry season each year, decided upon building a dam across a small meadow through which Bear River runs, and in 1900

active operations were commenced. To build a large storage dam in an isolated section of our State such as this location, a company is confronted with several serious and difficult problems. One of the most difficult is to solve the matter of the transportation of freight. The nearest railroad point to this dam site was Ione, about sixty miles away, and at an elevation of about five hundred feet.

Donkey engines, boilers, Burley machines, tons of giant powder, barrels of cement, the large gates and pipes, oakum, nails, blacksmith supplies, boarding house and commissary supplies, in fact everything necessary to equip and maintain a camp where from one hundred to one hundred and fifty men were to be employed, had to be hauled this entire distance. Ten- and twelve-mule teams were pressed into service, and a team would make a trip every eight to ten days. There was a continual up-grade from the time Ione was left until within five or six miles of Bear River, when a descent of five hundred feet is made. Still, with this great distance to haul all material over such a rough road, the records show that everything arrived on time and the work was never held up on that account.



Five Miles Down-stream from the Dam

At this time the old earth dams, which were practically the only ones constructed previously, were giving away to the more modern stone dams, so the dam at Bear River was built entirely of granite. It might be added that there was not much choice between the earth-fill dam and the stone dam on Bear River, as it is very doubtful whether enough soil could be found along Bear River from its source to where it empties into the Mokelumne River, a distance of about twenty miles, to build an earth dam 30 feet high and 500 feet long. On either side of the river, walls of granite extend up into the air several hundred feet, as will be seen from the accompanying illustrations.

In the construction of the dam two donkey engines were used to place the rocks, while a third donkey loaded the cars in the quarry. Steam was the motive power used to run the burleys, the machines being mounted on tripods. Several holes drilled in the granite walls were filled with ten to forty boxes of giant powder, and fired at once by electric exploders operated by batteries. When this charge was let off, thousands of tons of granite were thrown down, the largest pieces blasted again, then loaded on the car and started for the dam. Some of the rocks placed in this dam weigh ten tons each and it was necessary for both engines to place them in the wall.

The dam is 800 feet long on top while at the bottom it is only 200 feet. It is 120 feet wide at the base, 10 feet wide on top, and about 60 feet high. The rocks were laid at a 2-to-1 batter. On the inside of the dam, and set in the rocks at intervals of every ten

feet, 12x12 timbers were placed, and to these were nailed double rows of 3x9 native pine, each row being caulked with oakum and so laid that the outside layer of boards overlapped all the joints and cracks in the inside layer. In this manner the leakage was reduced to a minimum. The life of this lining is placed at from twenty to thirty years.

To furnish the lumber necessary for the construction of the dam and for erection of the various buildings for the camp, such as boarding and sleeping houses, barns, etc., the company built a sawmill on Little Bear River, a distance of three or four miles from the dam, and all the lumber had to be hauled this distance. The mill was located in one of the prettiest groves of timber that is in the State of California today. In driving through this grove one is awed by the immense number and the giant size and towering height of these magnificent trees. The writer secured a snap shot of a giant sugar pine which is located in this section. This tree is ten feet in diameter and at least 200 feet high. This grove is composed of sugar pine, yellow pine, fir, spruce and tamarack, so that the matter of securing the necessary timbers for the dam was a simple matter after the sawmill was erected.

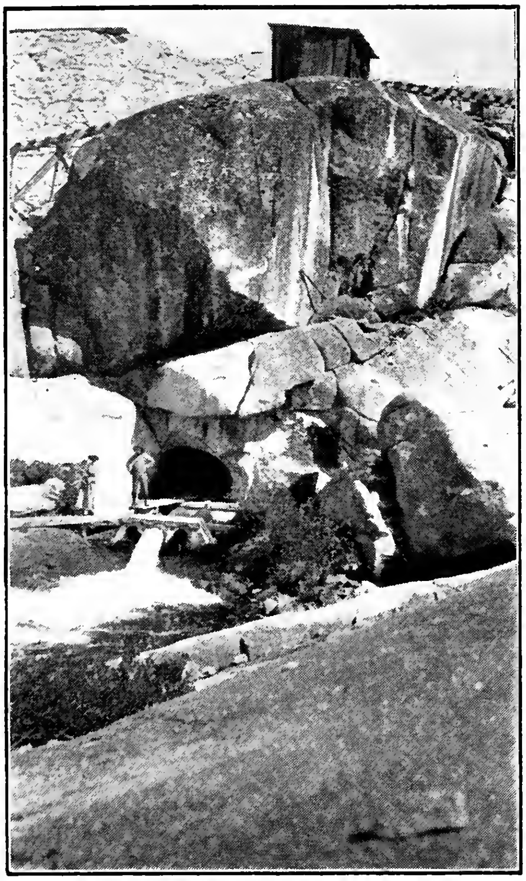
The reservoir was completed in the year of 1902, but the winter of 1902-1903 showed the necessity of a larger spillway, so in the fall of 1903 the spillway was enlarged until it is now 80 feet wide and 5 feet deep.

When the reservoir is full it covers an area of about 130 acres, and the water is backed up a distance of $1\frac{1}{8}$ miles. During some of the spring storms there is $4\frac{1}{2}$ feet of water running over the spillway, mildly illustrating that where a thousand gallons of water is stored today, a million, yes, ten million, might be stored and used to beautify the fertile valleys of the San Joaquin instead of being allowed to flood them in the wintertime.

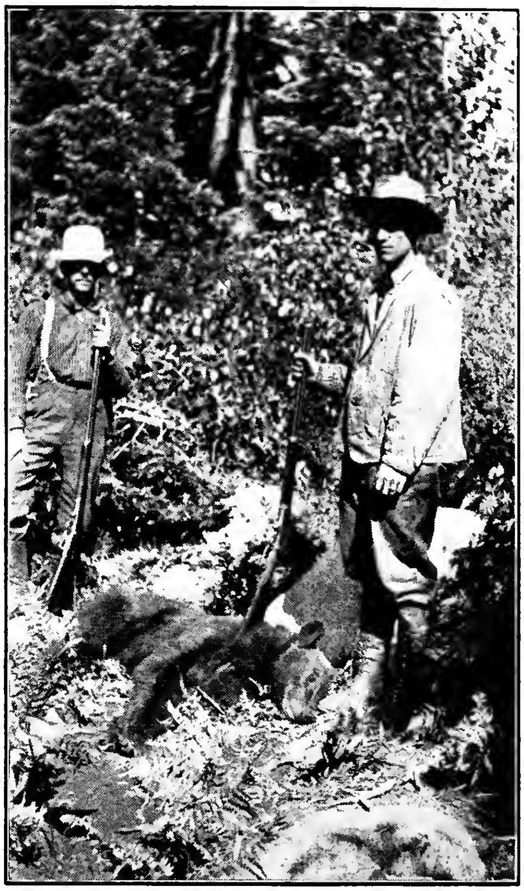
A tunnel about one hundred feet long, running through solid granite, taps the bottom of the reservoir. The water finds an outlet through three pipes leading through this tunnel, each pipe being fitted with a heavy gate capable of carrying about 1,000 inches of water.

The Bear River reservoir is the first to be drawn from each season, and after about ten or fifteen feet of water is drawn out, the gates are closed and the balance of the water is held until the close of the dry season, when it is drawn, provided it is needed. Telephone communication with Electra is kept open the year round with the possible exception of a few days in severe storms, and this is remarkable, considering the fact that some years they have as much as fourteen feet of snow on the flats. In the meantime storage water is drawn from the Blue Lakes, which are located about forty miles further east. In

On Bear River four miles below the dam. Granite walls rise 1,000 feet almost perpendicularly from stream.



Outlet of Bear River Reservoir. The flow through the middle pipe is 1,000 miner's inches.



Will T. Jones, L. L. Flagg, and a bear they killed on Bear River August 18th, 1910.

the late fall, especially after a severe storm, the telephone line usually goes down between Bear River and the Lakes, hence the advisability of holding the water in Bear River reservoir until the end of the season. Sometimes a storm in the fall will develop sufficient water for all purposes, and the storage water being ordered off, after a day or so the water might fail again, and with the telephone to the Lakes out of order, it is a very simple matter to have Bear River open up. This water reaches the head of the ditch a great deal sooner than it would from the Lakes.

One-quarter of a mile below the dam is located the weir or measuring box, and it is built in the usual manner, capable of measuring about 5,000 inches of water. Each day the reservoir attendant goes to the weir to see if the proper head of water is going over it.

Below this weir a short distance is located a water-fall with a height of twenty feet, and from this point down to where Bear River empties into the Mokelumne River, a distance of fifteen miles, one can find excellent trout fishing. These gamey little fish are attracted in the summertime by the ever-reliable "Royal Coachman" fly. The fish range from seven to twenty-six inches in length, though but few of the latter size have been caught. A string of fifty is a good afternoon's sport.

The reservoir is looked after by Fred Hodes, who has stayed there continuously for the past ten years, excepting the time that he took for his short vacation each fall. From the middle of October until the first of June

of each year, Hodes has a companion, as in the wintertime, especially during the heavy storms, it is very often necessary to remove huge logs that threaten to block the spillway.

Bear River is an ideal place to spend a few weeks each summer, either in pursuit of big game, fishing, or simply enjoying a good rest where nature has provided everything necessary for one's welfare, from excellent water to freedom from the wood and coal trust, and where one can enjoy the huge bonfires at night which make camp life like home. As is suggested by the name of the river, the country adjacent thereto abounds in big game such as deer and bear. The illustration accompanying this article shows a cinnamon bear that fell at the hands of Lester Flagg, the foreman of the Electra power house, assisted by Will T. Jones, the bookkeeper at the same place, during their vacation this late summer, which was spent at Bear River. Mr. Bruin was killed three miles from the dam, and weighed three hundred pounds.

Type F, Form P, Oil Break Pole Line Switch

OWING to the magnitude and complexity of the electrical distribution systems of the present day, it is very important in many cases that means be provided for cutting portions of the circuit in or out of service by suitable devices installed at points which necessarily must be remote from the station. Such a device must be designed for installation out of doors and for operation under load, and would find application in sectionalizing feeder systems, cutting in and out transformers and in similar service. To meet this demand the General Electric Company have designed an oil break switch which is simple, introduces no complications in wiring, and is easily installed.

This pole line oil break switch is thoroughly weatherproof. It is enclosed in a cast iron frame, fitted with a removable cover, and supplied with a gasket which prevents damage to the mechanism due to weather conditions. A detachable oil vessel, with insulating line and barriers between the switch poles, fits around a flange at the bottom of the frame. The stationary contacts are flared fingers of drop forged copper, supported from the contact blocks of the copper current carrying studs, by a heavy flat steel frame. The studs are supported by and insulated from the frame by porcelain insulators. The movable contacts are wedge-shaped copper blades hinged at one end. They are actuated by specially treated wooden rods connected to the shaft, which in turn is operated by the crank and handle outside of the frame. The construction of the stationary and movable contacts is such that any burning, due to rupturing the arc, is confined to the tips of the stationary contact fingers and the upper extremity of the movable contacts, preserving the actual current carrying surfaces. This feature of construction insures clean contact surface and uniform contact pressure without retarding the opening of the switch.

This switch is built in sizes up to 200 amperes at 15,000 volts. The switches up to 4,500 volts are designed for use with insulated wire, while for voltages between 4,500 and 15,000 bushings are furnished which allow the use of bare wire.

Morals In Trade and Commerce

A Lecture by Frank B. Anderson, President of the Bank of California (National Association), Delivered Before the Students of the University of California, Berkeley, February 15th, 1911, Under the "Barbara Weinstock" Foundation.

The most beautiful thing about youth is its power and eagerness to make ideals, and he is unfortunate who goes out into the world without some picture of services to be rendered, or of a goal to be attained. There are very few of us who, at some time or another, have not cherished these ideals, perhaps secretly and half ashamed as though to us alone had come an inspiration of a career that should touch the pulses of the world and leave it better than we found it. And in the making of youthful ideals we have changed very little with the passage of the centuries. The character of the ideals has changed with changing needs, but not we ourselves. Our young men still see visions; they still fill the future with conflict and with struggle and prospectively live out their lives with the crown of achievement in the distance. It is well that it should be so. The ideals of our youth are the motive-power of our lives, and even those of us who have lived far into the eras of disappointment would not willingly wipe from our memories even the most extravagant day dreams from which we drew energy and hope and fortitude and self-reliance.

If ideals have such a power over our lives, if they energize and direct our first entry into the world of affairs—as unquestionably they do—they must be counted among the real forces of the day and as such they are as much a matter for our scrutiny and control as educational development or physical perfection. Not, perhaps, in the same way, for our ideals belong to that private domain wherein we rightly resent either dictation or authority from the outside. But we can apply both dictation and authority for ourselves. With a firm determination to be upon the right side of the great issues of the day, to uphold honor and justice in public affairs, to uproot the tares and to sow the wheat in the domain of national business, we can apply our whole mental strength to a proper determination of those issues, to a correct distribution of praise and blame, to a careful adjustment of the means to the end and to a precise appreciation of the facts. We can satisfy ourselves that we have heard both sides and that enthusiasm has not deadened our ears to all appeals but the most noisy. We can see to it that our attitude is the judicial one and that our minds are so fixed upon the truth and upon the whole truth that there is no room for prejudice or for passion. All these things can be reared as a superstructure upon the groundwork of lofty ideals, for just as there can be no progress without ideals so there can come nothing but calamity from ideals that are not guided by reflection and by knowledge.

Never before has it been so hard to know the facts as it is today. If we must give credit to the press for the diffusion of knowledge so also must we recognize its equal power to diffuse prejudice and bias. The newspaper and the magazine of today are vast and intrinsic machines that supply the great majority of us with practically all the data upon which we base our judgments. The public mind and the popular press act and react upon one another, the press setting its sails to catch every wind of public interest and the public upon its part demanding to be supplied with all those departments of news to which at the moment it is specially attracted. Commercialism and competition have barred a large part of the press from its rightful office as leader and molder of opinion and have reduced it to the position of a clamorous applicant for public favor. The press, like everything else, is ruled by majorities, and in order to live it must cater to the weakness of popular majorities, it must reflect their prejudices, it must sustain their ill-formed judgments, and it must so sift and winnow the news of the day that the whims and the passions of the day shall be sustained. There are some newspapers and magazines that are honorably willing to represent only ripe thought and unbiased judgments, but they are not in the majority.

What verdict would the historian of the future pass upon the civilization of today if he were restricted to the files of our newspapers for his material. It must be confessed that we of today, in the hurry and tension of modern life, are hardly in a better position. Whatever we may suppose to be our attitude toward the press, with whatever scorn we may regard its baser features, it has an effect upon our minds far greater than we suppose. It is the steady drip of the water upon the stone that wears it away. It is the steady presentation of one aspect of human life, and that the lowest, that slowly jaundices our view and that produces either a rank pessimism or else an indignation against evil so strong as to efface judgment and to paralyze reason. Day after day we see human nature presented in its worst aspects and only in its worst aspects. We see fraud, cupidity, tyranny, and violence paraded before us as being almost the only activities worth reporting. Dishonesty is offered to us as the prevailing rule of life, and we are asked to believe that the spirit of commercial oppression has allied itself with the machinery of government for the oppression of a nation. It is a dreary picture, a picture that, if faithfully drawn, would justify almost any remedial measures within human power, a picture that by the skill of its presentation arrests attention and almost compels belief.

That we so seldom compare the picture with the original is one of the anomalies of modern life. And yet the original is before us and around us all the time, inviting us to notice that it is only the exceptional that is reproduced with attractive skill and that it is only he abnormal that is emphasized with adroit arrangements of line and color. Day after day we read of the sensational divorce cases, but there is not one line of the tens of thousands of happy marriages upon which no cloud of discord ever falls. Day after day we read of the scandals of municipal government, but how often do we remem-

ber the great army of municipal officials who do their whole duty devotedly, courageously, unselfishly? Day after day we hear of corporation tyranny, corporation lawlessness, or corporation greed, but what recognition do we give to corporations that obey the laws, whose operations are above censure and who add immeasurably to the wealth of the country and to the prosperity of every citizen in it? With this constant presentation of depravity, this incessant harping upon the one string of human dishonesty, what wonder that our visions should be distorted or that we should exclude from our horizon almost everything but the sinister features of modern life. What wonder that the young men and women should look at the career before them through an all-pervading fog of suspicion or that the days ahead of them should seem to be filled with the struggle against a universal dishonesty.

It is from such illusions as this that we must free our ideals if we would do effective work for the world and for ourselves. There are real enemies enough without erecting imaginary wind-mills to tilt against. Frauds, depravities, tragedies surely await us, now as ever, but we shall be doubly armed against them if we look upon them as the exceptions and not the rule and if we draw strength from the great background of human virtue and honesty. And there is such a background, unchanging, resistent, resolute, even though the limelight of publicity be persistently directed upon the few sinister figures on the front of the stage. We cannot afford to lose our faith in human nature, we cannot afford to shut out the greater and the best part of life or to gaze so persistently upon the abnormal that we can no longer see the normal and the ordinary. Let us cultivate our sense of ethical values and of ethical perspective rather than to crouch behind a shrub until it looks like a forest.

We are indebted to our commercialized newspapers and magazines for our distorted views of human life and for the cynicism that it is the momentary fashion to affect, but that is always disfiguring to the mind that harbors it. Certainly we can get no such views and no such cynicism from our own experience or from personal knowledge of the men and women who surround us. Honesty is a more familiar sight than dishonesty. All the commom and familiar processes of our daily life are based upon an expectation of honesty, and if you will stop to consider for a moment you will see that those processes could not go on without that expectation. And how seldom is it falsified. Sometimes of course there comes the jar of disappointment, but the fact that there is a jar shows that it is the exception and not the rule. However much we may talk of guarantees and safeguards and securities, however much we may talk of a business method or instinct that takes nothing for granted, it remains a self-evident fact that we must take human honesty for granted, that we must assume that the man with whom we do business intends to do it rightly and honorably, that he is actuated by a settled principle of fair conduct that will work automatically, and that without this automatically working standard of behavior all our guarantees and safeguards and securities would really have very little value. It is the universal expectation of fair dealing that makes business possible and, in fact, it is this universal expectation of good behavior that makes its breach sufficiently novel to be reported in the newspapers. If fraud and chicanery and violence were the order of the day, they would have no value as news. After twenty-nine years of dealing with human nature in a business where it is seen at its extremes—at its best and at its worst—I believe that the great majority of men and women in business are honest and I am certain that if this were not so, it would be impossible to carry on business. Take the statistics of the credit insurance business, a business that may be said to be based upon an assumption of human honesty; examine the statistics of the losses made in business and you will find that these are but a small fraction of the total amount involved and even this small proportion is chiefly due to errors of judgment or to causes in which dishonesty plays no part. Ask any banker how much he relies upon human honesty as an indispensable background to the ordinary precautions and safeguards of his business. Ask him what is his attitude toward a client whom he detects in a lie or in sharp practice, and he will tell you that he has no use for such a man. He would rather be without his business and free from all contact with those whose natural and innate sense of honesty is lacking. Go wherever you like, and you will find the same expectation, the same assumption of honesty. You will find that no business can be carried on without it. Whatever high and honorable ideals you may have formed you need have no apprehension that they will be scorned in the business world or that you will have to put them away to win success. It is in the business world that they will be valued, and even the mental equipment that you are now seeking will be less important to you, a lesser guarantee of success than your sense of honor and truth and probity. When you reach the business world—and many of you perhaps will go into the great corporations that are now ceaselessly paraded before you as wolves and as public enemies—you will find there the same kind of human nature that you find here in college, the same estimation of probity and of fair dealing. If you do mean or underhanded things, you will find that they are branded in the same way there as here. You will find that manliness and integrity are the rule and not the exception, and I will venture upon the prediction that when the time comes for you to look back upon your career you will see that there has been a steady improvement all along the line, just as those who are already able to look backward find that there has been an improvement since their own college days. But that will rest with yourselves, for the future is in your own hands. It is for you gentlemen, to see that moral and ethical progress is unbroken.

Now let me say a word about the corporations of which we hear so much in the newspapers and magazines and that are so persistently represented as enemies of the community and as vampires that are sucking the life-blood of the nation. I think there may be plenty of room here for clarification of our views, and, indeed, we should all be better for it if we could give more precision to our thinking and free ourselves from the imputations that have been allowed to cluster around certain terms. You may be sure that I am under no inclination to defend criminality or wrong-doing or to deny their existence wherever they are actually to be found. There are criminal corporations just as there are criminal doctors, and lawyers, and clergymen. Wherever men are gathered

together there you will find a certain number who are disposed to seek their personal advantage in reprehensible ways, but because some doctors and some lawyers and some clergymen are criminals we do not attach an imputation to their respective professions. We are content to say that there are black sheep in every flock and so pass on. But the newspapers and the magazines have seen fit to concentrate their attention upon the criminal or the illegal acts of certain individuals who belong to corporations and to explain those acts in a manner which often leads their readers to assume that the acts are an essential part of corporation business. As a result, the very word "corporation" has taken on a sinister meaning, and we are asked to look upon the corporations very much as the Rhine peasants used to look upon the robber barons who were accustomed to swoop down upon them and carry off their flocks. A corporation is absolutely nothing more than a partnership of individuals who prefer to do business under certain regulations imposed by the government. There is no difference between the corporate and the individual ways of doing business except a piece of stamped paper issued by the Secretary of State. The corporation is made up of individuals who have just the same ideas of honor as you have yourselves, who have just as much integrity, just as great a love of fair play. A man does not change his nature just because he turns his business into a corporation any more than he changes his nature because he moves from one street to another or from the first floor to the second. A corporation then is a combination of men that has been formed under the sanction of law to carry out certain projects that it would be difficult or even impossible to carry out in any other way. The men forming those corporations are just such men as we meet in daily life, no better and no worse, and therefore with all those normal inclinations toward honesty that we are conscious of possessing ourselves and that we are in the habit of finding in others. The fact that these men have formed themselves into a corporation is no more significant of evil than a combination or a partnership among doctors or laborers. It is a part of the spirit of the age, an age that is called upon to do great things, to develop vast natural resources, to feed and clothe great centers of population, and to undertake a hundred other enterprises too large for the strength of the individual. I should like you to think over the real meaning of this term "corporation" in order that you may understand that it has no sinister significance whatever, that it is nothing more than a partnership that has registered itself under certain legal conditions for purposes that are laudable and honest. If you will do this, you will understand at once how senseless is the outcry against corporations as such and how absurd it is that any stigma of dishonesty should be placed upon a particular form of doing business that is exactly like other forms of doing business, with the addition of a legal registration. As I have already said, there are some corporations that break laws, or rather certain individuals who are parts of corporations and who break laws, just as there is a certain small proportion of law-breakers in every section of every community. But that fact carries with it no reflection upon corporations as such, and when our sensational publications and politicians use the word "corporation" as though it were an alternative term for brigand or pirate they are simply assuming a public ignorance that may exist outside, but that certainly ought not to be found within a university. They are taking advantage of a nearly universal disposition to believe one's self injured and are appealing not only to ignorance, but to a low form of cupidity and of mob greed. They would have no success in their crusade against corporations as such if there were any general understanding of the meaning of terms or if it were generally recognized that there are thousands of corporations in this State, and thousands in every State against whom no whisper of wrong-doing has ever been raised and who are doing a useful work, of which every individual among us is a beneficiary, directly or indirectly. Now it is not only in our definitions that we need to be precise and to think clearly. We have already seen the need of a better discrimination between the very few corporations that are accused of breaking the laws and the vastly greater number that we never hear of at all and that do their business as quietly and honestly as the baker or the butcher. If lawbreaking is to be found in the business of some corporations, it is incumbent upon us to determine just in what way the law is being broken, why it is being broken, what sort of law it is that is being broken, and how much moral turpitude or public wrong is involved. All these factors would be determined by a judge upon the bench before passing sentence upon the meanest malefactor, and yet we find that the public is constantly urged by the newspapers to pass sentences of ruin and confiscation upon corporations as a whole, with their tens of thousands of innocent stockholders, without any kind of inquiry and under the influence of uninformed passion.

There is no department of ethics more disputed than the meaning of abstract right and wrong, and as I am not talking either on philosophy or ethics I will ask you to accept just such common-sense definitions as can be applied to the business world and that may be usefully employed as a working basis. Commercial morality and honesty are determined by each community for itself in the light of its own special needs and point of evolution. Today we hold many things to be wrong that were done by our forefathers with clear consciences, and on the other hand we now believe that many things are right that were held by our forefathers to be wrong. There was a time when slavery did not offend the most delicate conscience, and if we go still further back, we shall reach a time when theft was almost the only crime recognized and when wholesale murder was a virtue. Every age had its own standards, and it would be absurd to argue that an act was wrong if it received the sanction of the whole community. It was the communal conscience that determined all problems of right or wrong, and it is still the communal conscience that gives us our definitions of morality and honesty. Here, in my opinion, is where a great part of our trouble arises. The communal conscience has changed, and some things regarded right and proper twenty years ago are frowned upon today. But business methods tend to become rigid and inelastic, and a sudden evolution of the public conscience leaves them in the rear. Then comes a sudden recognition of the disparity, and laws are passed to prevent the practices that formerly went unchallenged. Usually these laws are passed in a hurry and by politicians who have no clear grasp of the problem. As a result the laws are ineffective.

That is to say, business, clinging conservatively to its familiar ways, finds a plan to continue those ways in spite of the laws passed to prevent them and then public opinion, finding no relief, is angered,—not at the breaking of a law, but because the law itself was ill-designed and ineffective. In other words, public opinion has failed in its effort to force the individual to set aside his own interests for what public opinion considers to be the interests of the community. Public opinion in this country is not a steady and persisting force, as it is in some older communities. It moves spasmodically and after long periods of quiescence and usually under some stress of excitement, which prevents deliberation and therefore effectiveness. Law being more unwieldy than conditions, naturally lags behind them, and what we have to recognize is a change in conditions and in laws and not an outbreak of lawlessness. Another evil result from the impetuous way in which we make laws is that they are not enforced because they are not in harmony with the views of the community. The statute books of every State are encumbered with laws passed in moments of hysteria and never put into operation, or else allowed to lapse after a few months of confusion. Every newspaper in California, for example, breaks the law every day when it prints a news item without appending the name of the writer, and probably we are all of us breaking laws of which we never heard. This sort of thing brings a law into contempt and robs it of the sacredness that should attach to it. The Sherman anti-trust law, for example, would bring the whole business of the country to a standstill if it were strictly enforced, and I believe it is not good to bring large and innocent sections of the community within the scope of a criminal law simply for the purpose of reaching a minute proportion whose methods are flagrantly bad. If the Sherman anti-trust law were enforced, it would have to be repealed at once, and I think honest traders have a right to complain of a law that makes them technical criminals and is enforced only against notorious wrongdoers. The law should be so framed as to reach only wrongdoers and to leave honest traders outside of even its technical scope.

President Roosevelt was emphatic in his declaration that he intended to enforce the Sherman anti-trust act, and during the four years beginning with 1902 his administration was active in that direction.

In 1906 he stated: "Combinations of capital, like combinations of labor, are a necessary element in our present industrial system. It is not possible completely to prevent them; and, if it were possible, such complete prevention would do damage to the body politic. It is unfortunate that our present laws should forbid all combinations, instead of sharply discriminating between those combinations which do good and those combinations which do evil.

"It is a public evil to have on the statute-books a law incapable of full enforcement, because both judges and juries realize that its full enforcement would destroy the business of the country; for the result is to make decent men violators of the law against their will and to put a premium on the behavior of the willful wrongdoers. Such a result, in turn, tends to throw the decent man and willful wrongdoer into close association, and in the end to drag down the former to the latter's level; for the man who becomes a law-breaker in one way unhappily tends to lose all respect for law and to be willing to break it in many ways. The law as construed by the Supreme Court is such that the business of the country cannot be conducted without breaking it."

But let it be admitted that there are cases where abuses exist and where methods of doing business that were harmless enough and even necessary enough a few years ago are now working hardship upon the public as a result of changed conditions. These abuses should be corrected; there is no question about that, and they will be corrected either by violent methods that will leave behind them a heritage of bitter resentments and wrongs or by the way of a real statesmanship that will recognize only facts and that will do justice by methods that are themselves just. For a long time to come it must be the greatest of all problems confronting the statesmanship of our day, a problem that must try our patience and our capacity for self-government. Do not imagine that America stands alone on this perilous path of reform. All the countries of civilization stand in the same place. All are confronted with the same conflict between new ideals and old methods, between the spirit of today and the mechanism of yesterday. The problems of other countries arise from their own peculiar conditions just as our problems arise from our conditions, but their essence, their purport, is the same. And do not imagine that there is any one solution that can be applied or that there is any virtue in the sovereign cure-alls that are clamorously urged upon us by demagogues and by reformers who are eager to reform everything and everybody but themselves. There is no such panacea. It is to be found neither in municipalization, nor nationalization, nor confiscation, nor any of the nostrums advocated so wearisomely by sensation mongers. There is indeed no hope for us except by laborious study of conditions and by an infinitely cautious advance from point to point, so that there may be no injustice, no concessions to prejudice, no incitements of class feeling, no embittering of relations that should be cordial as between citizens of the same republic, whose differences are infinitely small as compared with the well-being of a great nation. Of all the dangers that threaten the path of the reformer that of injustice is the greatest. It is better even that abuses should continue for a time longer than that they should be corrected by injustice and by the infliction of hardships upon those who are wholly innocent. Two wrongs can never make a right, and wherever we find a so-called reform that is based upon injustice be assured that we are only substituting one evil for another and that our latter end shall be worse than the first. It would be impossible for one now to indicate the direction in which reforms should lie, and there is of course nothing human to which reform is impossible. But it is perhaps suitable that I should indicate some of the ways that can end in nothing but calamity, however alluringly and speciously they may be advocated. For example, there is neither good sense nor honesty in penalizing a corporation because some of its officials have done wrong. Wherever wrong has been done, the guilt is with some individual and not with the corporation as a whole. Find out who that individual is and let him answer to the law, but do not visit his misdeeds upon innocent stockholders who have had nothing whatever to do with the offense, who knew nothing of its commission and could have done nothing to prevent it if

they had known. Remember, that a penalty inflicted upon a corporation is actually inflicted not upon guilty persons, but upon innocent investors.

Let me give an illustration of the so-called "reforms" that are recklessly urged upon us today and that are to be found in operation here and there throughout the country. I refer to the matter of street franchises. Now it may be true, it probably is true, that in many cases these franchises have become of great value and that they ought not to be granted without adequate return. But would it not be just to remember that when these franchises were originally granted they provided a service that was absolutely essential to the growth of the community and that those who obtained the franchises faced a serious risk to their capital and practically threw in their lot with the prospective welfare of the city? It is hard to realize how serious that risk sometimes was and how problematical were the returns. The shareholders in these street traction corporations are spread over the population and every class of the population is represented in them. They invested their money in good faith at a time when no question had ever been raised as to the propriety of these franchises and at a time when these franchises were considered to be for the public good and indubitably were for the public good. And I will ask you if it is honest to use all the machinery of the government, all the artifices of the politician to depreciate the value of those franchises, to threaten their holders with confiscation, to hamper and harass them by all the ways that are open to a democratically governed people? I say unhesitatingly that it is dishonest to do these things, and I will go so far as to say—believing as I do in the good faith of the great majority—that most of those who noisily advocate such measures would be ashamed to do so if they would but face the facts and understand what it is that they are actually doing and the wrong that they are inflicting upon innocent men and women. If mistakes have been made in granting franchises, then take care to avoid such mistakes in the future, but do not enter into a bargain that seemed advantageous to yourselves and then repudiate it when you find that it is not so advantageous as you thought. There is no way to reconcile such a thing with common honesty, and it is in no way mitigated by the fact that it is done by a community and by means of a vote rather than by an individual and in the ordinary small affairs of life. We all know what we should say of the man who acted in this way toward ourselves personally, but in advocating some of the schemes that are now recommended to us by sensational politicians, newspapers, and magazines we are making ourselves responsible for a dishonesty far greater than the evils that we are trying to remedy. Let us by all means reform whatever needs to be reformed, but let us do it with clean hands.

Now, I think that I have said enough to justify my belief that these great problems of our social life are not of a kind to be settled off-hand by violent or radical legislation. They are not to be settled by any one scheme or by any one plan. The only way to approach them is by careful and conscientious thought, a minute examination of the facts at first hand and a rigid determination to act toward corporations and business interests in general in the same spirit of unswerving honesty that you would wish to display to a comrade or to a friend and that you would wish to be displayed toward yourselves. You will find that honesty is the royal road to success in commercial life, and it is also the royal road to all reform in our communal life. Do not go out into the world with any expectation that you will be required to surrender the ideals that you have formed in your youth, or that you will be asked to choose between honor and success. Those ideals will be the greatest capital with which you can be endowed. They will attract to you everything that makes life desirable and without them you can have neither self-respect nor the respect of others.

And as a last word let me recommend you not to be carried away by those gusts of prejudice and passion that sweep periodically through the community. There is a contagion in these things that it is hard to resist, and so much that today passes for thought is not thought at all, but merely the automatic, unreflecting acceptance of wild theories that are enunciated with so much force that they seem to be almost axioms. Your study of history will show you that the world has always been subject to these waves of emotion, that are sometimes religious, sometimes political, and seem for the time to carry everything before them. We are passing through such a period now, a period of intense unrest, of revolt against conditions that we ourselves made, against methods that we ourselves created and sanctioned. I advise you to look askance upon every movement that in the language of the day is called popular. Do not accept a theory or a doctrine because it is popular, but on the other hand do not reject it for that reason. Do not permit yourselves to be carried off your intellectual feet by indignation or by protest. Demand of every political theory that it stand and deliver its credentials, and before you allow it to pass into the realm of your adoption, see to it that you understand it in all its bearings and that you have traced its results so far as is possible to your foresight; let the final test be one of human justice and of honesty, and then with courage use your power to aid in the formation of public opinion, remembering that public opinion is after all the great controlling force.

Stockton Water Company Bonds To Be Redeemed

On April 1st, 1911, bonds of the par value of $238,000.00, secured by mortgage upon the property of the Stockton Water Company, will become due.

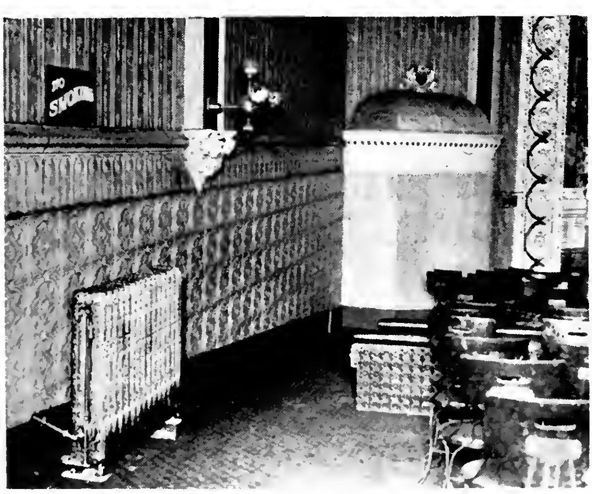
Arrangements have been made with the Illinois Trust & Savings Bank, Chicago, Illinois, Trustee under the mortgage securing these bonds, to pay the same upon presentation by the holders. Interest on the bonds cease April 1st, 1911.

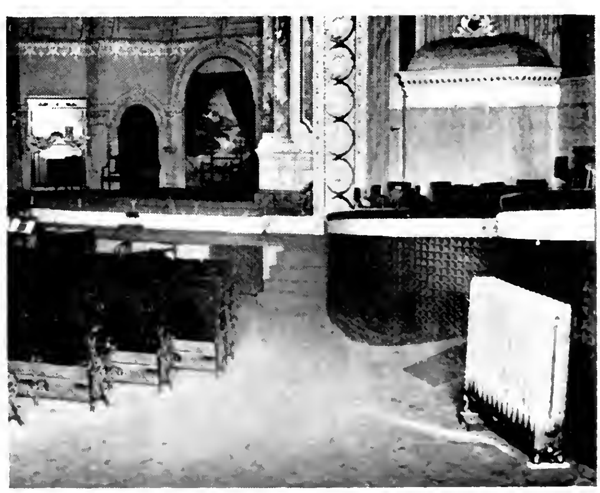
The Globe Theatre

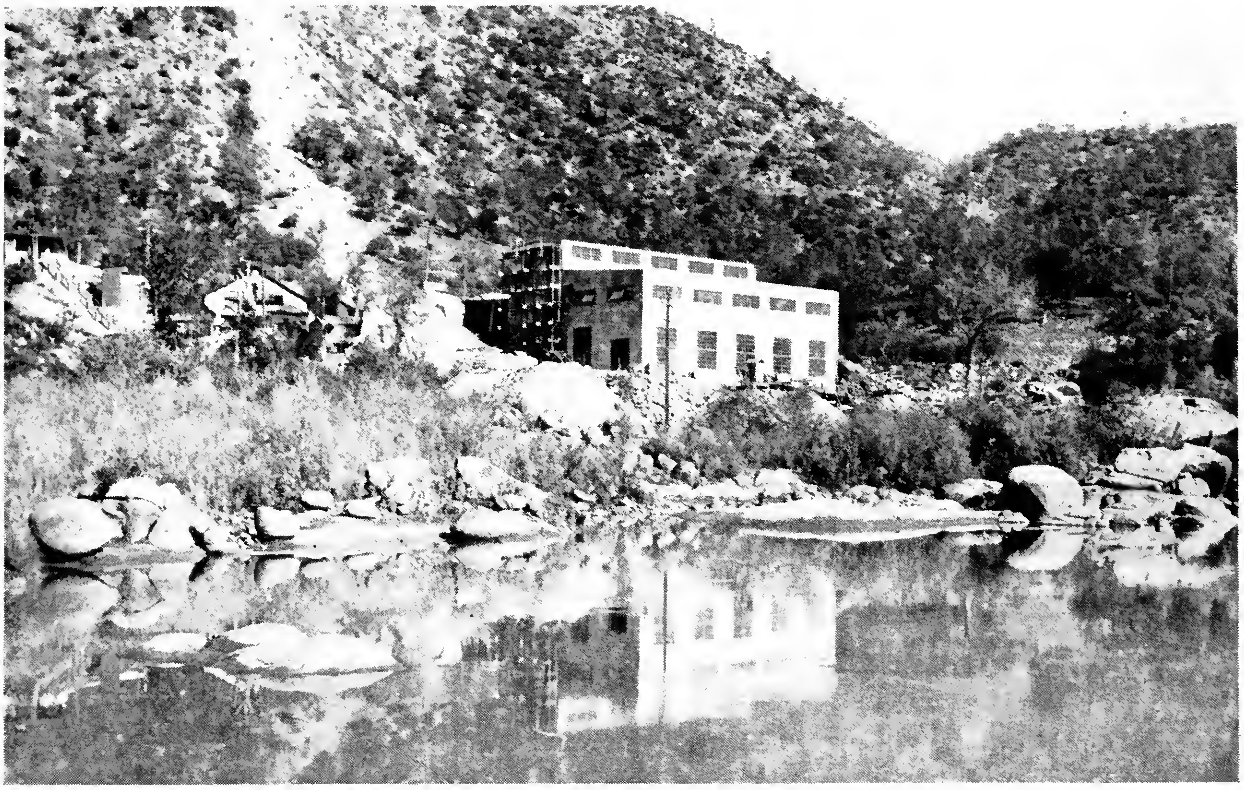
Model Theatre Gas-Steam Heating System

THE THEATRE, particularly the modern show house, with its light vaudeville or motion pictures where the passer-by whiles away a pleasant hour beguiled by marvelous feats or views of strange lands or shadow dramas, is becoming one of our most pronounced American institutions. Looking after the material comforts of his patrons is one of the theatre manager's greatest cares. Good ventilation and comfortable, healthy heat are two of the prime requisites. The majority of the San Francisco show houses have settled the heating question by installing Gasteam Radiators, which afford pleasant agreeable heat with automatic regulation and reasonable fuel bills. The installation is cheaply and easily made at a fraction of the cost of a central heating plant. This system has proven peculiarly adaptable to San Francisco needs and there are at the present time some 36,000 sections of Gasteam Radiators installed in various churches, fraternal halls, stores and apartment houses. The accompanying photographs show the Globe Theatre, one of the largest of the Mission play houses, which is entirely heated by this system.

These Gasteam Radiators were installed by the Gas and Electric Appliance Company, San Francisco.







San Joaquin Power House

Hydro-Electric Development of San Joaquin Light and Power Corporation of Fresno, California

By HENRY A. LARDNER, Pacific Coast Manager of J. G. White & Co.

THE San Joaquin Light & Power Corporation of Fresno, California, started business in 1896 with a hydro-electric plant of 1050 K. W. capacity, located on the San Joaquin River, thirty-seven miles from Fresno. This plant utilized the natural run-off of the North and South Forks of the San Joaquin River, diverted through seven miles of earth ditch of fifteen cfs. capacity, to a regulating reservoir directly above the power house, where a head of 1400 feet was obtained. At that time this was famous as the greatest head in existence.

A rapidly growing business soon necessitated an additional unit in this power house, now known as No. 1. Then followed the construction of the Crane Valley Reservoir ten miles above the intake of the original plant on the North Fork, and still later the construction of the No. 3 power plant, with 401 feet of head and two 1000 K. W. generators.

Today the Corporation's business and territory have expanded until it includes the San Joaquin Valley from Merced to Bakersfield. The most recent addition to their facilities is herein described and consists of increasing the Crane Valley Reservoir storage capacity twelve fold; of remodeling and enlarging the conduit line to the No. 1 power

house, and the construction of a complete new power house of 16,000 K. W. capacity served by two duplicate pressure pipe lines.

The old Crane Valley dam, once famous as an example of hydraulic fill construction, is enclosed just within the up-stream toe of the new dam, which is 150 feet high above the canon bend, and 1865 feet long. For about one-half this length, over the deep portion of the canon, the section of the dam consists of an up-stream earth fill and a down-stream rock fill section, with an intermediate corewall. At each end, and especially to the west where the heigth of dam does not exceed 50 feet, the section is of earth on both sides of the corewall. The crest width is 30 feet on earth fill section, and 15 feet where rock fill is used. The corewall extends the entire length of the dam and has a top width of 2 feet, with batters 1 in 50 through the rock fill section, and 1 foot top with batters 1 in 75 through the earth fill section. The foundation below the earth fill is hard disintegrated granite, into which the corewall is trenched 10 feet or more. The rock fill section is founded on solid granite. The up-stream earth slope is riprapped 2 feet thick, and the down-stream slope, where of earth, has 1 foot riprap.

The rock fill material was quarried near the dam site and dumped into place from trestles, with some hand work in placing rock against the corewall. A good compact fill was thus obtained to give stable support to the corewall. The record output from the quarry to the dam was 600 cubic yards in 10 hours and 19,000 cubic yards in one month, using two shifts.

The thin corewall is of 1:2½:5 concrete, carefully placed to give a water-tight septum.

Frame Work for Concrete Corewall, Crane Valley Dam

It is well reinforced by using $\frac{3}{8}$-inch plain square bars at top and increasing to 1-inch bars at maximum depth.

While it was originally intended to construct the earth fill by using steam shovels, cars, and rollers, prospecting for suitable earth developed an excellent material for

Gate House, Crane Valley Dam

hydraulic fill, close to the dam and to one of the conduits, and at sufficient elevation to give a 4 per cent grade to the top of the dam at its east end. This material was coarse disintegrated granite, with an admixture of red clay at one place and solid red adobe clay at another, and by water segregation the coarser material was deposited on the slopes of the fill, while the impervious clay was deposited next to the corewall. Two monitors were used, with nozzles from one to three inches, the size of the nozzle depending on the available water. Water was brought six miles over the mountains in ditch and flume and delivered to the nozzles under a 350-foot head.

The spillway for flood discharge is located in a canon at suitable elevation to give a 70-foot length of sill 8 feet below reservoir level. Nine-foot flash boards maintain proper level and furnish means for providing sufficient waterway for floods. The excavation is in disintegrated granite, paved with concrete, and final discharge is on hard rock and thence down the canon.

The outlet control works consist of a concrete tower erected in the reservoir just outside the upper toe of the dam, and connecting to a shaft and a tunnel through the rock beneath the dam leading to a concrete forebay controlled by needles and discharging over a weir into the old No. 3 conduit line, and also discharging into the natural stream bed by an overflow spillway 38 feet long.

The new dam impounds 51,000 acre feet and collects the run-off of an area of 52 square miles on the North Fork and 26 square miles of the South Fork.

The reservoir area of 1200 acres was largely covered with timber, mostly yellow pine, with some cedar and oak. This has been cleared and sawing yielded 3,500,000 feet of lumber. The best lumber was shipped out as back freight, while the balance was used for construction purposes.

The transportation of materials for the dam was entirely by team, there being on the road between Friant station and the dam site, a distance of 36 miles, as many as fifty 8 to 12-horse teams.

The original conduit of the No. 1 plant was simply a side hill ditch excavated in disintegrated granite. Though the air line distance between intake and the regulating reservoir is barely four miles, the length of the conduit was fully seven miles, due to the length of the contour.

The made bank of the ditch was tenanted by thousands of gophers and ground squirrels, which, in spite of a constant warfare waged against them by patrolmen using poison, traps and rifles, caused leaks, resulting in washouts of sections of the bank and consequent expense for repairs. The problems presented in remodeling this ditch were to increase the capacity to one hundred second feet, to eliminate the gopher troubles, to shorten the line and still maintain the flow of water for uninterrupted operation.

The line as now constructed consists of 10,775 feet of concrete-lined tunnels five feet wide, six feet high, with semi-circular top; 12,300 feet of earth ditch in disintegrated granite with one to one slopes and a concrete corewall in the made bank; 715.5 feet of concrete flume where earth ditch was impracticable owing to a formation of ledge and boulders, and 966 feet of steel flume supported on heavy timber trestle where the conduit spans a canon.

Several designs for a concrete-lined ditch, both as wet placed and slab block schemes, were estimated upon and rejected owing to the difficulty and cost of handling the water and to the danger of interruptions to power operation. The scheme finally adopted was to enlarge the old ditch in earth and to introduce a concrete corewall into the made bank. The excavation was first carried to the water line and on Sundays when it was possible to cease operation of ditch all hands were put into the ditch to complete the bottom.

The corewall trench was dug two feet wide, braced, and to a depth of two feet below the bottom of the ditch, or deeper if necessary, to secure good bottom. Six inches of concrete was placed in the bottom of the trench to serve as a base and the corewall 6 inches thick was erected between forms made in panels. These panels did service a great many times, as they were braced from the bank and spread by 6-inch blocks, thus obviating the necessity of spiking or wiring. The top of the wall was finished one foot above the flow line for 100 cfs. so that the ditch has considerable over-load capacity. The reinforcement in the wall consisted of Clinton woven wire cloth, 3x12-inch mesh, No. 6.10 gauge, seven feet wide.

At two points near the head of the conduit the ditch widens out to form ponds of about $\frac{1}{3}$ acre area. These ponds were utilized as sand traps by building a submerged rock-filled crib, with tight sheeted face across them normal to the flow.

Each pressure pipe varies from 44x$\frac{1}{4}$-inch lap riveted pipe at the top, to 34x$\frac{3}{4}$-inch lap welded at the bottom. Near the top is installed a Venturi meter and automatic recording apparatus.

The trench was dug square down a spur of the mountain forming one wall of the main river canon. Most of the drop occurred in 3000 feet, which is extremely rough and steep, the maximum grade being 77%. The mountain is bare of vegetation other than chapparal brush, and is composed of disintegrated granite with hard rock dykes and cliffs. It became a serious problem to keep labor on the work, for, besides being extremely hazardous and laborious, the heat was intense, dust hung over the trench in clouds and rattlesnakes fell into the trench so frequently as to require stationing a man to dispose of them.

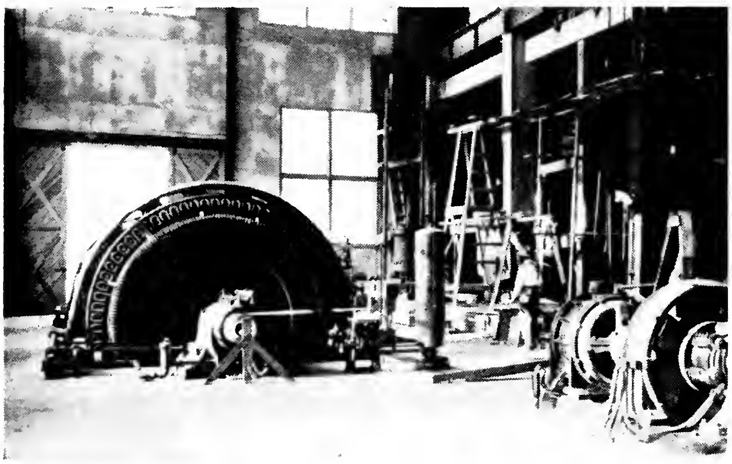
The pipe was furnished in thirty-foot lengths with maximum weight of 10,000 pounds. These were hauled forty miles to the head of the pipe line on special long-reach trucks with cradle bolsters. To handle the delivery of pipe on the steeper portions of the hill, a tramway of three feet gauge was built alongside the trench on top of the excavated material, the maximum grade being 100%. Probably a more crazy, crooked, or unevenly graded tramway never existed.

The pipe was laid from the power house up—the lower end was bulkheaded and the pipe filled with water as fast as laid to prevent extreme expansion and contraction. Back filling followed the frequent anchorages, though the bell holes were left open until after final test and rough rock walls were laid up to keep these holes open. The whole operation of installing the pressure pipe was attended with the fullest success. No accident to person or property resulted, all anchorages held and no serious leaks occurred.

The Power House is located on the bank of the river and founded on solid ledge and disintegrated granite.

The building is 148x71 feet 6 inches of fire-proof construction and designed for coolness, as the summer temperatures run very high here. It has structural steel frame, covered with hy-rib and Portland cement plaster $1\frac{3}{4}$ inches thick. The outside walls are double with 8-inch dead air space. The intermediate floors and roof are of reinforced concrete and "I" beam construction, the roof being water proofed with white top asbestos roofing, which afford considerable heat insulation.

The generator room contains four overhung 6100 H. P. Doble impulse wheels direct connected to 4000 K. W. General Electric generators, 3 phase, 60 cycle, 2300 volts, 400 rpm., arranged in pairs at each end of the generator room. Each pair is served by a single penstock which branches within the building to serve the two units. Each branch is controlled by a 24-inch hydraulic gate valve and terminates in two needle regulated nozzles, one below the other. The upper nozzle is the effective or working nozzle and its needle is direct connected to a Lombard type "Q" governor. The lower or relief nozzle has its needle positively connected to the main needle and is so arranged that it opens automatically and discharges free below the buckets, when the main needle closes rapidly or beyond a predetermined point, thus maintaining sufficient vent to prevent dangerous over pressure in the pipe line. The relief is further provided with a slow closing device, which gradually closes the needle in the event that the main needle remains closed, thus effecting a saving in water.



Interior of San Joaquin Power House

The transformer equipment consists of four banks water cooled 1500 K. W. transformers, wound for 2300/60,000 volts and fitted with quick opening discharge valves and piping, leading to a tank outside the building.

The construction of the power house presented but few unusual details. Practically all material and equipment arrived at the same time so that one main unit was erected complete and running continuously as soon as the steel was completely erected and before roof, walls or gallery floor was placed. Temporary line connections were run direct from the transformers to outside lines.

During 1910 the conduit was completed and one pipe line, two exciter units and two main generating units installed. The large dam has been under construction since June, 1909, and will be completed by March or April, 1911. During the coming summer will be installed the second pipe line, another exciter and two main generating units. This interesting and successful work has been designed and executed by J. G. White & Co. for their clients, the San Joaquin Light & Power Corporation.

Brighter Now

Mrs. Jones—I suppose your house is much brighter now on account of the new baby.

Mrs. Smith—Yes, we burn twice as much gas as we used to.

Shocking

Waiter—Everything here is cooked by electricity, sir.

Customer—Well, take this egg away. It shocks me.—*The Gas Arc.*

Electric Talks

V.—Primary Batteries

By JOSEPH P. BALOUN, Head Draftsman.

A BATTERY or electric cell is generally a device for converting the energy set free by chemical action into electrical energy. These cells are also known as voltaic and galvanic; names derived from Volta and Galvani, the discoverers of many electrical laws and principles and inventors of many valuable instruments and apparatus. These two Italian scientists are the first to share the honor of having made the first chemical generators of electricity.

There are many forms and types of batteries, but they all depend upon the following principles for their action. If two pieces of metal or other conductors of electricity, the two being of a widely different character, be immersed in a chemical solution in which one dissolves more rapidly than the other, an electric pressure or electro-motive force is produced. If, instead of allowing the two conductors to touch, a wire is lead from one electrode and connected to the other, the electric current will flow through the wire and any other electrical devices that may be connected. When this electric current is generated and flows through the battery circuit one element or electrode that is found to be the most affected is gradually eaten away and the quantity of the substance that is dissolved is proportionate to the rate of the flow of the current and the length of time the current is supplied by the battery, that is, the amount of the electrode dissolved is proportionate to the electricity removed from the cell. Where there is no connection between the two electrodes the chemical action is greated lessened, and in some types of cells it almost ceases.

If a rod of zinc and a cake of carbon be immersed in a vessel containing the conducting liquid (called electrolyte) we have the simplest form of a practical voltaic cell or battery, and if a connection be made between the two electrodes, the current will flow from the carbon, through the wire connection and to the zinc; thence from the zinc passing through the liquid to the carbon, thus completing the circuit. The electro-chemical theory of a battery is that the current passes through a liquid and the water in the liquid is decomposed into its elements or constituent gases, viz: hydrogen and oxygen, the oxygen forming at the electrode which the current leaves to pass into the liquid and the hydrogen forming at the electrode which the current passes in leaving the liquid. The action of the hydrogen and oxygen is to combine with the chemicals in the liquid and form a compound which destroys one or both electrodes. Hydrogen being a decided electro-positive element, its accumulation on the negative electrode is a great detriment, as it tends to neutralize the electro-motive force of the cell. Furthermore the bubbles of gas prevent good contact between the liquid and the electrode and thus introduce a resistance to the passage of the electric current. These effects are called polarization and quickly cause a battery to reduce its electro-motive force. A battery, however, soon recuperates after a short period of rest, when these hydrogen bubbles pass off. It may be interesting to know that the tongue can be used to represent both the vessel and the electrolyte of a battery. If a bright silver dollar is placed on the upper side of the tongue and allowed to project so as to come in metallic contact with a piece of zinc placed against the under side of the tongue, a very peculiar and unpleasant taste will be noticed as soon as these two electrodes come in contact, due to the miniature electric

current, causing a decomposition of the zinc element.

The following is descriptive of various types of batteries:

Sal-ammonias cells are used for intermittent service. such as supplying current to electric bells, etc. This cell is made up of one electrode of carbon and one of zinc immersed in a solution of sal-ammoniac. The electrolyte has a proportion of five ounces of ammoniac to one quart of water. This type of cell has a voltage of 1.33.

The Leclanché cell is a sal-ammoniac type with the zinc and carbon electrode immersed in a sal-ammoniac solution. In addition, manganese dioxide is placed in the cylindrical carbon electrode. Its valuable feature is that it combines with the hydrogen formed at the electrode, thus making a new compound, and making the battery serviceable for continuous duty, for it will no longer polarize.

The bichronate cell consists of carbon and zinc electrodes immersed in sulphuric and chronic acids. This type is often called the plunge battery, for, on account of the disadvantage of the zinc being eaten away, even though the current is not flowing, the electrodes are made so that they can be readily raised from or submerged into the electrolyte. This battery has the advantage of a high voltage when fresh, usually two volts.

The gravity, blue-stone or crow-foot cell is a closed circuit type of battery and must be continually in service, otherwise it is subject to injurious action. The electrodes consist of a cast copper positive and a cast zinc negative with radical projections thereon, thus giving them the appearance of feet, hence the name "crow-foot." The copper electrode lies at the bottom of the cell while the zinc electrode is suspended near the top. Copper sulphate or bluestone is placed in the bottom of the cell. When the cell is filled with water, and the circuit is closed, the zinc will dissolve and form a zinc sulphate, while copper from the bluestone is deposited on the copper electrode. If current is not taken from the cell, the bluestone solution will rise and deposit copper on the zinc which will produce a harmful action. Hence the necessity of keeping the zinc sulphate solution at the top of the cell separate from the copper sulphate at the bottom by having the battery in closed circuit all the time. The voltage of this type of cell is 1.1.

The Edison Lalande cell is made up of a positive electrode of zinc and a negative electrode of copper oxide, these being immersed in a solution of caustic soda and potassium. A thin layer of paraffine oil poured on top of the electrolyte seals the solution from the air. The voltage of this cell is about .7.

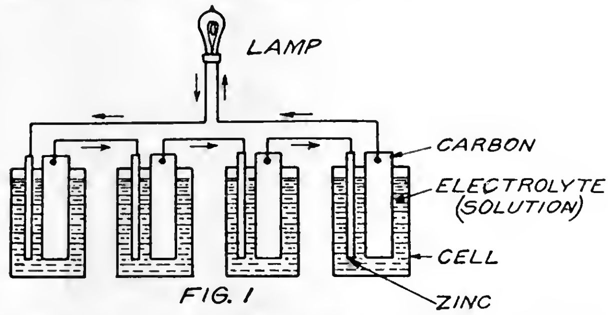
The Bunzen and Grove cells are of the two fluid type, the solution being separated by a porous partition. The batteries are capable of producing powerful and constant currents for a short duration of time. They are quite expensive, however, and are used principally in the laboratory for experiments. They produce nearly 2 volts.

The chloride of silver cell, which is usually quite small, is used extensively for portable testing sets, etc. The electrodes are zinc and silver rods sealed in small glass tubes containing the electrolyte which is often a zinc sulphate, zinc chloride or a caustic potash solution. Using a zinc sulphate solution the voltage is about 1.1.

The Mesca, Gassuer or other dry types of cells are different from those described above, in that the exciting fluid is combined with some absorbent such as sawdust or else is made into a sort of jelly. These batteries are portable, non-spillable and very convenient, for these reasons rapidly taking the place of many of the above liquid types. The voltage of the cell is about 1.4.

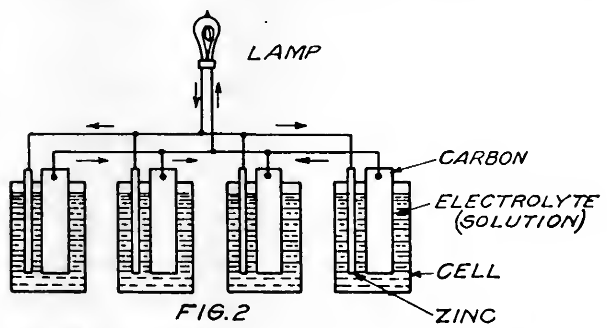
To produce a greater voltage batteries are connected together — either in series or parallel, or some arrangement of both methods.

Fig. 1. shows a method of connecting cells in series. Since all the current used passes through each cell, the amount of current or amperes which may be taken from the total number of cells thus connected is equal only to that which one cell is capable of furnishing. If the cells vary in size, the electro-



motive power or voltage is not affected, being independent of the size of the cell. The current which may be taken from the battery is limited to that of which the smallest cell is capable of delivering or discharging.

Fig. 2 shows a method of connecting cells in parallel. All the zinc electrodes are joined together and all the carbon electrodes are joined likewise. Thus connected the voltage of the circuit is equal to that of any one cell,



but the available current is the sum of the current which the different cells are capable of delivering. All the cells thus connected to must be of the same type and give the same voltage, otherwise the high voltage cells will discharge into those of low voltage.

The New "Harem" Skirt

The latest new skirt is the "harem;"
'Tis time for the girls to prepare 'em.
For, no matter how bum
It will look, there are some
Who are perfectly crazy to wear 'em!
—*Gas Arc.*

Tire Pointers

Air costs nothing; tires are expensive.

More tires give out from insufficient inflation than anything else. Remember that it is the air in the tube that carries the load and cushions the road.

Avoid sudden application of the brake.

If one side of a tire shows more wear than another, turn it around.

Running a tire flat, even a short distance, is sure to be costly.

Better run on the rim, very slowly and carefully, if imperatively necessary, and the distance is very short, than on a flat tire.

Keep grease and oil away from your tires and tubes always. They destroy rubber.

Do not drive in the ruts or bump the side of the tires against the curbing or pavements.

See that the size of the tires is in keeping with the weight of the machine and the load it is likely to carry.

Do n't start your machine with a jump.

If one of your tires sustains a cut to the extent of exposing the fabric, an emergency band or patch should be applied at once.

We would recommend keeping an odometer record of the mileage of each tire. You will find that you are getting better mileage than you would otherwise imagine.

Make sure that your tires are large enough to carry the load.

Do not employ tires of a size barely adequate to carry weight of car and its occupants.

You ought to have a margin of tire strength to go and come on.

The occasional increased load or burst of speed overstrains; the construction of the tire is weakened, and the final blowout is the result. In order to meet and overcome such conditions, where existing, the makers of tires afford car owners the opportunity to use tires of larger diameter, as well as circumference measurement, without change of rim. While the initial expense of such tires is slightly greater, the ultimate advantage of additional mileage far more than compensates.

Volcano Kilauea on the Island of Hawaii

By W. H. SPARLING.

View of the Crater of Kilauea from the Hotel.

THE volcano of Kilauea is situated on the southeastern slope of Mona Loa, at an elevation of 4,000 feet. It is oval in shape, the bed of the volcano being about 1,000 feet below the lava plains that surround it.

According to data obtained at the Volcano House, the crater is 7.85 miles in circumference, has an area of 2,650 acres, and is 15,500 feet in length by 10,300 feet in width, and is said to be the largest active volcano in the world.

One of the chief points of interest is the crater Halemaumau, which means "House of Everlasting Fire." It is irregular in shape, about 150 by 250 yards across at the top; tapers away toward the bottom, and is said to be about 1,900 feet deep. It is situated at the northeastern end of Kilauea and constantly emits dense clouds of smoke, steam and sulphur vapors which are plainly seen from the hotel, the "Volcano House," about two miles away.

It was about four in the afternoon when I had my first glance into the firey pit of Halemaumau. The great mass of liquid lava was boiling, bubbling, splashing and emitting volumes of smoke and gases and making a strange rumbling noise. The lava seemed to be about 100 feet below the 2,650 acres of the main crater. I was told that a few days previous the lava had been within fifty feet of the top. The afternoon and night we spent on the brink of the crater, the lava rose twenty feet, being much more active than usual.

Madam Pelee, "Goddess of Fire," who, according to old Hawaiian legends, resides in Halemaumau, must have been on a rampage for my especial benefit, for the cracks and crevices about the top were spitting more steam and heat waves than ever. Our guide

was making coffee and boiling eggs over a crack, while others of the party were scorching souvenir postals to send to distant friends.

Our guide stated that the lava usually boils up in one place only, called "Old Faithful;" at that time it was boiling everywhere. One moment the white liquid stone would dash southerly splashing against perpendicular walls, while a few seconds later it flowed in a dozen different directions.

A huge lump of cold lava had broken loose from one side of the wall floating like an island in the lava pit below and being gradually melted as shown by the clouds of smoke and vapor that rose about its edges.

Crater Halemauman, as seen in the daytime.

A thin sheet of congealed lava formed every few moments, only to be broken up, its fragments scattered and dissolved in the more active sections of the boiling pit. What seems strange is that the breaking up process is never the same. In the daytime this sheet has a hazy, slat-blue color, while at night it is a dead black.

Across this thin crust there creeps a narrow slit of dazzling brightness, barely visible at first but gradually widening until the molten lava creeps through in streams of pure white, which quickly turns to red, then takes on a brownish hue. The slit continues to widen until it becomes a wide gap and the flake floats into the more active parts where it is quickly broken up in large slabs which stand on end and disappear from sight. Gradually another sheet forms, this time covering more than half the surface of the pit; below are heard strange rumbling noises and the thin crust begins to heave and roll. Suddenly numerous punctures appear through which

Night Picture of the Lava Pit.

gases and spurting lava shoot thirty or forty feet into the air, forming little geysers and falling back on the surrounding lava; giving vent to the strange crackling and tearing noises that are heard. The punctures enlarge until large holes are formed through which the fresh lava flows, breaking up the mass in flakes which are quickly dissolved and carried away and the whole pit is again boiling, and seething as merrily as ever. Again this crust of congealed lava appears. A winding crack opens. At first it is white, like the spurting lava which flies up in all parts of the pit. The break widens; in the center a threadlike line turns black, and a little way further the white turns to a golden color, then red and then to a brown; leaving numerous vari-colored stripes extending in all directions. This lasts only a few seconds; the steady swell from below crushes it to pieces and sends it hurling into the surging mass.

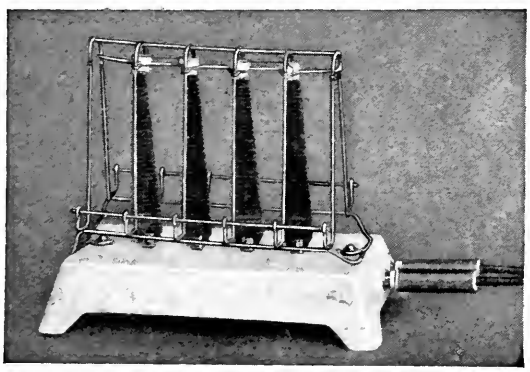
The most interesting and fascinating feature about this wonderful display of natural force is its rapid change. The scene is never the same; it never repeats itself.

"Doctor, I've tried everything and I can't get to sleep," complained the voice at the other end of the telephone. "Can't you do something for me?" "Yes," said the doctor, kindly. "Just hold the wire and I'll sing you a lullaby."—*Success Magazine.*

Improved Vertical Radiant Toaster

The electric toaster is, perhaps the most popular of the various electrical cooking devices now available. It is one of those remarkable articles, which so completely satisfies all the requirements of real convenience and utility, that it is rapidly attaining the character of a modern household necessity wherever electric current is available for domestic use.

When the General Electric Company brought out the first vertical type of toaster, its advantages were so apparent that it received quick recognition as ideal in its line. This appreciation was well merited because the new design enabled the making of two slices of toast simultaneously, greatly reducing the time and cost, and increasing the convenience of preparing the favorite breakfast dainty.



The vertical type of toaster not only represented a marked advance in the direction of increased utility, but served to establish the superior value of Calorite as a resistance material for producing intense radiant heat under the influence of an electric current. As in the case of tungsten, tantalum and other metals used as efficient light givers, the history of Calorite, the new metal used as an efficient heat giver, is too familiar to bear repetition. It is significant, however, that its production practically renders unnecessary any further development for the present of the electrical component of electric heating and cooking devices. On the other hand, modifications in the mechanical design and construction of any class of devices, for the purpose of increasing their utility, beauty or convenience, are always more or less possible, and electrical cooking devices are no exception to the rule.

The 1911 model of the G-E vertical radiant toaster embodies new features, very commendable to prospective users of such devices. The inclined rack has been substituted for the perpendicular holder of the earlier design for increasing the convenience of the toaster. The slices of toast are thus rendered more accessible, and can be turned around more readily during the process of toasting.

The individual contact plugs adopted for the ornamental electric heating and cooking devices are applied to the new toaster. The plugs are incased in polished nickel cylinders, which add to the attractiveness of the toaster and places it in harmony with its companions on the buffet.

Storage Battery in Goldfield

The Electric Storage Battery Company has just completed the installation of a storage battery regulating outfit of unusual character in Goldfield, Nevada. The purpose of this outfit is to absorb heavy fluctuations due to the operation of large alternating current electric hoists. It will incidentally reduce the maximum power demand by discharging at the peak of the load. The storage battery floats across the direct-current brushes of a synchronous motor-generator set, automatically absorbing all fluctuations and maintaining a steady load on the transmission lines. The battery consists of 120 cells of "Chloride Accumulator" type G-35, having a capacity of 250 kilowatts for one hour, and takes momentary fluctuations up to 600 K. V. A.

A contract has just been closed with the Esmeralda Power Company for a similar installation in Tonopah.

Public Service Commission Relations

By H. M. Edwards. *Electrical World*, June 2, 1910; p. 1471.

The writer reported that during the recent legislative seasons acts providing for the regulation and control of electric light companies were passed in New Jersey, Maryland, Mississippi, and South Carolina.

An act has been passed in Virginia providing for the taxation of franchises. It requires corporations to report their property located in the streets and highways and the value thereof.

All of the foregoing States require annual reports from the corporations, and New Jersey and Maryland have authorized their commissions to establish a uniform system of accounts so that comparisons with other corporations, wherever located, will therefore be possible. The writer urges every member company of the N. E. L. A. to adopt the Association's uniform system of accounts with a view of having this system adopted by all public service commissions.

The Economy of Small Lighting Units

London Journal of Gas Lighting, May 3, 1910; Editorial, p. 294.

In discussing the question of electric competition the witer says:— "The electric canvasser may go into a gas consumer's house; and the chances are that he will find throughout the house—in ordinary rooms, in the bedrooms, in the hall, on the landings, in lavatories, bathrooms, etc.—"C" burners using (say) 3½ cubic feet per hour, or a large form of inverted burner, representing in their uniformity an unnecessary waste of gas. No wonder that in such a house an electrical canvasser, by cutting down his lighting units to such a point that, in his imagination, will be suitable for the purpose, is able to give the householder an estimate (the word should be underlined) as to the annual cost of lighting that, in some cases, in comparison with the gas bill for lighting only, is not altogether unattractive. That this is so, is due entirely to the insufficient use that is made of the types of gas burners that, while being small in consumption, are very efficient.

Gas Station "B," Oakland

Said the maker to the helper,
As he lit her for the burn,
At editing that magazine
I would like to have a turn.
I'd surely ask them why it is
That they can never see
Anything to write about
At Oakland, Station "B."

Said the helper to the maker,
Well, you see you cannot spend
The time to make us famous
At our little Oakland end.
Although we have the talent
We cannot spare an hour
From our business at the gas machine
Making twenty-candle power.

Said the maker to the helper,
As he lit up with a "boom,"
They can write about electrics
And the way to fix a flume.
There's economy and history, also biography,
But not a word that I have heard
'Bout Oakland, Station "B."

Said the maker to the helper,
Use the secondary blast;
I am pretty sure this sort of thing
Was never meant to last.
Thar's merit here at Station "B,"
Although it is not seen,
But some day we'll get a write-up
In the 'lectric magazine.

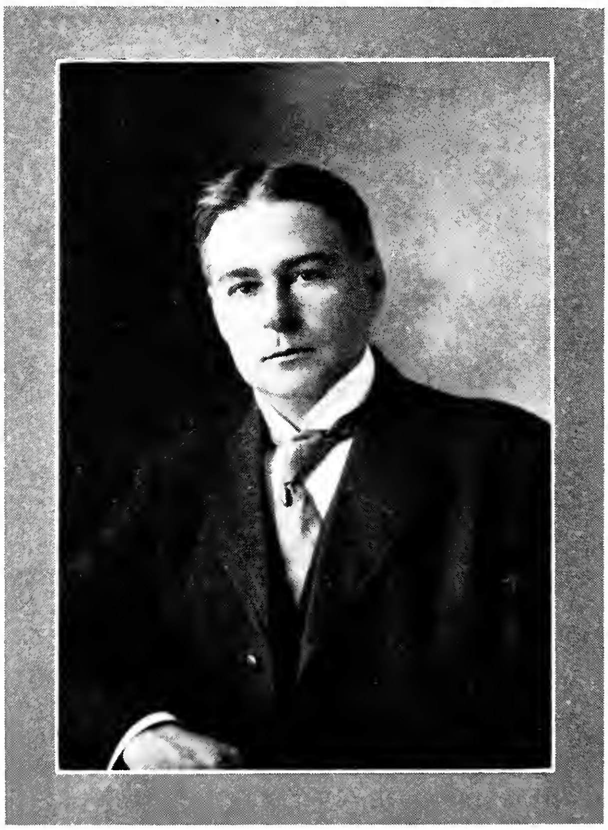
J., STATION "B."

Note by Printer's Devil: The literary proclivities of "J" indicate his ability to furnish an interesting article on the equipment and operation of Station "B." Try it out.

MEN OF THE COMPANY

ROY JEROME CANTRELL

There is an old saying that runs something like this: "Satan finds much mischief still for idle hands to do." Conversely, the busy hand has no time for the mischief that pleases his Satanic Majesty.



The industrial life of the growing boy must be always productive of inner thoughts for his own betterment and for the growth of the ambition that lifts men above the position occupied, to those of more activity and responsibility.

Of the men of the Company, Roy Jerome Cantrell emphasizes, by his development in life, the well-worn statement that "there is always room at the top."

He emphasizes also, that, in the general administrative and executive sense, collegiate education, while an essential help, is not always a necessity in the development of the brain power of the man.

Collegiate training does polish, does rub off the rough corners, but in many respects it is only a thin veneer in concealing the sturdy work behind it which forms the foundation.

Roy Cantrell is one of the younger generation of Native Sons.

He first saw the light of day among the rugged pines and rocks of Siskiyou County, California, having been born in the little hamlet of Yreka, on March 3d, 1873.

His parents, like all of those of early California days, were nomadic in their tendency, and went from place to place, endeavoring to better their fortunes, and in order to give their offspring a firmer hold upon the physical things of life.

The education of young Cantrell was therefore divided territorially, part of it being in Yreka, part in San Diego, and part in Seattle.

While his hand has not been turned to the plow, it has been turned to the plane and the saw for shaping of material things for the building up of cities, for when fifteen years of age he devoted himself to work in the planing mills of his father, then afterwards dabbled in electricity with the Edison Company in Seattle, and with that ambition that has marked his entire career he determined to master the mysteries of shorthand, which he accomplished by devoting his nights to that purpose rather than to the usual friv-

olous spending of nights that is unfortunately so common with some of our growing youths.

This knowledge of stenography made it possible for him to obtain a position with the Pacific Gas and Electric Company in 1904, under Mr. C. W. Conlisk, then Secretary and Treasurer.

His activities, abilities and indomitable energy did not leave him long in the class of stenographers. He became almost immediately a confidential secretary.

While it has been an easy matter, so far as his strenuosity is concerned, to rise above even that position, it has been accomplished with hard knocks and hard work, and today he occupies the responsible position of Property Agent of the Company.

By his efforts in that position, in thinking out and putting into effect means and methods for diminishing the fire risks of the several properties of the Company, he has been able, not only to save it actual expenditures of coin, but to prevent, by the able study made of situations, the occurrence of fires, and has reduced that hazard in the various plants to a minimum.

In the standardization of the stationery of the Company and the care and taste exercised in the publication of our magazine, he has evinced that artistic ability which runs throughout his entire family. Cantrell is an ever living lesson to those who, in their snug complacency, are content to let things rest, and evidences by his every act a constant activity of mind, looking primarily to the betterment of those with whom he is associated, and secondarily to the accomplishment of his ambitious instincts.

He has taken upon himself also the care of a family, at present consisting only of a loving wife, to whom he was married May 25, 1907. Perhaps he is debating as yet whether the Roosevelt theory is correct, and perhaps he is not. That we must leave to himself.

Anyhow, whichever way you look at it, he has made good.

"Evening"

By CLEMENT ARNOLD, S. F. Substation "D."

Beyond the snow-capped peaks
A cardinal sun sinks flaming to his rest;
All birds and beasts to sylvan haunts retire,
Expanding shadows creep across the fields.
The varied colors of the brighter hours
Fade slowly, gently to a monotone,
While evening with a cleft, and zephyr touch
Upon the expiring breath of day,
Her purple curtains draw.
The breezes in the tree-tops die,
The murmur of the rippling brook is stilled
And brooding Silence with the Night holds sway.

Pacific Gas and Electric Magazine

PUBLISHED IN THE INTEREST OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - - - - EDITOR
A. F. HOCKENBEAMER - - - BUSINESS MANAGER

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Matter for publication or business communications should be addressed

PACIFIC GAS AND ELECTRIC MAGAZINE
445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. II MARCH, 1911 No. 10

EDITORIAL

THE following communication appeared in the editorial columns of the *Daily News*, of the issue of March 4th, 1911, and was commented upon by that paper:

"Editor *Daily News*—You are a fair-minded man and try to run a fair paper, yet you ask the question: "What's the answer to this problem?"

The answer is that the Los Angeles Gas Co. and the Eastern gas companies pay starvation wages and work their men 12 hours per day.

San Francisco gas workers are paid top-notch wages and are only required to work 8 hours per day. Does it sound good to you?

Don't you think that for these square dealings with help any company should at least be given the credit of dealing justly with their men? And don't you think Los Angeles can well afford cheap gas when they pay starvation wages and only require two-thirds the number of men to make and distribute their product?

Please give this a prominent place in your good paper. A GAS WORKER."

While we have no conception of the personality of the Gas Worker who pleaded for fair treatment for the Company by which he was employed, it is gratifying to know that the workers of the Company are imbued with the loyalty which causes them to plead for their Company, when they feel it has not been rightly treated.

In the columns of this magazine, from time to time, have been printed editorials and excerpts from other publications, dwelling upon the principle of loyalty, and evidently the seed sown has found good ground in which to germinate and flourish, and to bear fruit.

The editor of the *News* is to be complimented for his publication of the above communication, for in this hysterical age, when reforms are running wild, and where the "Big business" and "The interests" are held up to public scorn, and made responsible for all of the ills to which the human flesh is now heir, the voice of the Corporation or of its advocates are seldom heard through the columns of the press, and it is, therefore, with a feeling of satisfaction that the editor finds an awakening of the spirit which promises to give fair play to all concerned, as exhibited by a willingness to give the other side of questions.

That in the lust for gold some corporations and their managers have, in the past, brought upon themselves the deserved criticism of press and people, is no reason for wholesale condemnation of all corporations at the present time.

To differentiate between corporations acting in good faith and those who do not even make a semblance of doing so, should be the province of those educators of public opinion, the daily press of our country.

In the immediate matter which brought out the communication from the Gas Worker, the question at issue was a relative fairness of rates as between the cities of San Francisco and Los Angeles, the *Daily News* having previously, editorially and otherwise, commented adversely on the contentions of the San Francisco Company, claiming that if gas could be sold in Los Angeles for 80c, there was no reason why it should not be sold in San Francisco at the same price. The fallacy of this argument must be evident to

any thinking person, as rates are not based on questions of location, but entirely upon questions of a just return upon the capital invested, and as well might the *Daily News* argue that because it sells the issues of its journals for 1c, all other San Francisco papers should sell their issues at the same rate.

We close as we begun, by commending the loyalty of our Gas Worker, and we anticipate that more than a majority of our workers, both gas and electric, are equally loyal, and we have confidence that if, when they find the Company they are serving attacked by the press unjustly, they would submit their honest views to the press as did this Gas Worker, that a new and better sentiment of just and fair treatment to our Company would prevail over the length and breadth of the territory which it covers.

The following changes in the territory and management of district offices were made by order of the Vice-President and General Manager:

Effective March 15th, Mr. Don C. Ray will assume the position of District Manager of Contra Costa District, vice Joseph Mayo, resigned. Mr. Ray has been with the Company at Grass Valley since May 22, 1901, latterly as bookkeeper and cashier.

Effective April 1st, the town of Benicia and adjacent territory connected to the distributing system of that town will be transferred from Solano District to Contra Costa District.

Effective April 1st, the towns of Antioch and Black Diamond, now in Contra Costa District, will form a separate department to be known as Antioch District, with Mr. F. J. Southerland as Manager. Mr. Southerland is now connected with the Electric Distribution and the Industrial Departments of the San Francisco Gas and Electric Company.

Effective April 1st, the following Lighting Districts in the County of Placer, now under the jurisdiction of the Sacramento District, namely Newcastle, Loomis, Rocklin, Rosevile, and all contiguous and intervening territory, and the town of Lincoln, now under the Marysville District, shall constitute a new district to be known as the Placer District, and Mr. H. M. Cooper, with headquarters at Auburn, is hereby appointed as District Manager of said district. The office of the Second Vice-President and Treasurer will arrange for the method of accounting, as effecting said new district, and the transfer of said accounts from the Sacramento and Marysville offices.

The Colgate-Sacramento transmission line between Smartsville and Lincoln will be reconstructed at a cost of $21,370.00. The work will begin at an early date and some of the poles are already on the ground.

The new station at Smartsville is in service and the town now has "Electric Lights" and an "Electric Piano." The people of the town took up a subscription and raised money to have street lights which are now in service.

The Chico Substation is undergoing repairs. The high tension switch gallery has been entirely rebuilt, the high tension disconnecting switches reconstructed and various new instruments installed on the Secondary Switchboard. An automatic regulator for the town lighting service is the next improvement to be added and will probably be installed during the coming spring. The new substation at Colusa is ready for service. The extension of the 60 K. V. line from Meridian to Colusa will be completed about the middle of April and when this new apparatus is put in service, consumers at Colusa will receive the best service the Company can give.

How to Increase the Gas Output

By D. E. KEPPELMANN, Superintendent Gas Service and Meter Department.

HOW can the gas output, cubic feet per meter installed, be increased?

The foregoing question is one of the many submitted to the employees of the Meter Department occasionally, the writer herewith submits a summary of the answers sent in:

1. A real solicitor.
2. By employees.
3. Advertising.
4. Gas Appliances.
5. Having secured a consumer, take care of him.

First: Requisites for a real solicitor.

Enthusiasm.

Neat personal appearance.

Familiarity with conditions.

Practical knowledge.

An accommodating spirit.

Truthful statements.

Control of temper.

The exercise of extreme care in the matter of promises.

Gentlemanly persistence and patience, and entire absence of familiarity either in manner or speech.

Second: By Employees.

The public gains its knowledge of any company through its employees with which it deals. A successful company necessitates the confidence and respect of the public with which it deals. Employees stimulate this confidence and respect by endeavoring to make the name "The House of Courtesy" synonymous in the mind of the public for "Good Service," "Square Dealing," and "Courteous Treatment."

Third: Advertising.

An intelligent instructive educational display ad. in newspapers, changed frequently, signs in street cars and demonstrations for the public, periodically.

Fourth: Gas Appliances.

Talk Gas Appliances. There are any number of gas appliances on the market too numerous to mention, which are practical for almost every known trade, the Manufacturer, Contractor, Builder, the various Artisans, and Industrial establishments. The field is large and each appliance added increase the cubic feet per meter.

Fifth: Having secured a consumer take care of him.

It is a failing with many companies to secure a consumer and then forget all about him, with the possible exception of reading his meter, coldly rendering a bill and expect it paid. A solicitor's work should not end with having secured a consumer, but he should inaugurate a system of periodical visits or social calls. He should be sufficiently practical to talk gas and gas appliances. A systematic inspection of appliances at frequent intervals should be inaugurated. Many appliances installed are used little or not at all, and when used with poor results, simply for the want of a slight adjustment. Are you satisfied? Any complaints? Is your gas supply alright? Are your appliances in good order? These are a few of the queries. Go over the premises with a consumer, teach him gas, gas appliances, how to use his appliances to get the best possible results, teach him to read a meter and he will observe the interest you have taken in him, which results in not only a satisfied consumer, but stimulates the cubic feet per meter as well. Many complaints arise due to the ignorance of the consumer in connection with the gas meter, therefore teach him that it is the only existing medium between the company and the consumer. Tell him it was invented, patented, and put on the market *Sixty-six years* ago, and today remains the same as originally in-

vented. What better argument could be asked for, in view of the fact that many later and much used mechanisms have lost their identity entirely, having been greatly improved upon. The gas meter remains identically the same, and is used throughout the civilized world. With respect to the accuracy and reliability of the gas meter, tell him we are aware of the liability of any mechanism to get out of order, however it is a well known fact that the gas meter is the less liable of most of these, proven by its practicability since the day it was launched upon the commercial world, and conceded to be more accurate than the best time pieces manufactured; exhaustive tests having been made by the best engineers known, comparisons having been made with watches from the better known manufacturers.

A satisfied consumer is a company's best asset, therefore satisfy him and he becomes a voluntary agent for the company which not only stimulates the cubic feet per meter, but secures protective consumers as well.

Jamestown, Cal., Feb. 28.

Editor Pacific Gas and Electric Magazine.

Dear Sir:—I am not writing this with any view to publication, as I realize that there will be nothing of worth in it, but simply to show an appreciation of your efforts to gain a better understanding with your employees.

In reading the January number of your magazine I was especially interested in the editorial. It seems to me that if more corporations were to take the same view of Capital and Labor there would be less labor trouble.

While there never was a time in the world's history that the working man was as well off as he is today, he could still be more efficient and of greater use to himself and his employer if a fuller understanding existed between the two.

"Trust a thief and he loses half his desire to steal" is a quotation from I don't know where, but at any rate it can be applied to all classes of men. Trust a working man, let him feel that he is on his honor and he will give his best in most cases.

It is true that living is very much higher than in the past; what were considered luxuries a few years ago are bare necessities now, but the average working man can have something besides four walls to kill the numbness of routine after the day's work is done, if he so chooses.

Greater efficiency of the employees means less cost of production, higher wages, cheaper gas and electricity to the Company's consumers, and that in time means a few more dollars saved by our brother workman.

FLOYD HAMPTON, Patrolman,

All that begins must end!

The iniquitious inquisition of the 16th century, the baleful bastile of the 18th century, the sizzling slavery of the 19th century—all dragged their weary way to the bitter end, and then there came a change.

In the full-orbed splendor of our modern civilization, the on-rushing spirit of progress has called into being a new champion of the humble and oppressed. The cold, steel-tipped fingers of science have fashioned a new instrument of precision, and now in this 20th century, after an hundred years of persecution, of heartless gibes and of merciless ridicule, a long suffering servant of mankind has been rescued from a false position in the mind of the multitude; no longer to be regarded as the premier prevaricator, the chief conspirator of the age.

The hour of emancipation is at hand! The lowly gas meter is superseded by the lordly taximeter as an inspiration of wicked newspaper jokes. Read and rejoice:

"The gas meter took a ride in the taxicab. For the rst mile it watched the recording dial and was confident.

"At the end of the second mile its confidence had waned.

"At the end of the third mile it threw up its hands, tumbled through the doorway in a dead faint and smashed its defeated innards on the cruel stone pavement.

"But the heartless taxicab meter merrily meted away."—*Cleveland Plain Dealer.*

PERSONALS

Mr. J. W. Brown, accountant and stenographer of the Stockton Water Company and Miss Violet Haney of Stockton were married in San Francisco on February 22nd.

Grass Valley, March 1.—Yesterday afternoon Miss Mamie J. Hartung entertained a number of friends at a whist party at the pretty Hartung home in Pleasant Valley. After the prizes were awarded the guests were invited to the drawing-room, where a surprise awaited them. In the center of the table was arranged two large hearts which concealed tiny sealed envelopes from which extended red ribbons. Before sitting down to the table the guests were instructed to draw the ribbon. They did so and found the envelopes attached contained the announcement of the engagement of Miss Mamie Hartung to Benton H. Wilcoxon, head bookkeeper of the Pacific Gas and Electric Company, stationed at Electra, Amador County. The groom was formerly accountant at the Colgate power house for the same company. Miss Hartung is the daughter of Mr. and Mrs. N. Hartung, her father being one of the wealthiest farmers in this section of the State—*Sacramento Bee.*

Gas Arc Awards

We report the following from the *Progressive Age* of January 11, 1911:

The gas arc lighting prize contributions closed with our November 15th issue and the committee have agreed upon the winners in the contest, as announced in the following report:

Progressive Age Publishing Company,
New York.

Gentlemen: We, the undersigned committee selected by you to consider the articles and make the awards to the authors who submitted papers in your "Gas Arc Lighting Competition," beg to advise that we have considered all of the articles entered in this competition, sixteen in number, and it is the unanimous opinion of the committee that the awards to the authors should be made in the following order:

First Award, $50—"Gas Arc Lighting," by Augustus H. Johnston, Oakland, Cal., Gas Light and Heat Company, which appeared in your issue of July 1, page 573, being article No. 2 of the competition.

Beautiful Eyes

There are eyes of many colors,
And eyes of every style,
But the eyes you see in Gasville
Have got 'em skinned a mile.

Boggs' left eye is discolored,
It's painted out almost,
He says, when asked who did it,
"I bumped against a post.

And Simpson got his somewhere
His right lamp is on the blink,
He says he got it chopping wood,
He did, yes? I don't think!

There's Hyland with his optic
Done up in black and blue,
He ran into a rose bush,
That's what he tells to you.

His face is full of scratches,
There are two on his right cheek,
A green shade now he's using,
There's a puncture in his beak.

"Now Black and Blue," says Hyland,
"Is a home-like color, boys;"
But McCarthy says a hatpin
Causes damage without noise.

Of course their tales sound fishy,
But they don't go with the bunch,
The "low-down" I will whisper—
"*They went up against the punch.*"

E. A. B.

Baseball News

THE baseball teams of the San Francisco Gas and Electric Company and the Oakland Gas Light and Heat Company played the first game of the season at Fruitvale Saturday afternoon, Feb. 25th. The San Francisco team won by a score of 10 to 2. The features of the game were Scanlon's pitching, Barthol's batting, and the fielding of Steele, Trowbridge and Wrinkle. Weber pitched a fine game for Oakland, besides making three safe hits.

Oakland's challenge is the best two out of three for a dinner. The second game will be played in San Francisco Saturday afternoon, March 18th, at the St. Ignatuis ball grounds. The members of the home team are confident that it will be "two straight" for them, and are very busy sharpening their appetites for the feast which, they say, Oakland is doomed to pay for.

Mr. Cusack umpired the game and Harry White was scorer. The score:

SAN FRANCISCO GAS AND ELECTRIC COMPANY

	AB	R	BH	SB	PO	A	E
Mensing, lf.	4	1	0	1	0	0	0
Barthol, rf.	5	1	2	0	1	0	0
Wrinkle, cf.	5	3	1	1	2	1	0
Murphy, c.	4	2	0	2	8	2	0
Steele, 1b.	3	2	0	2	8	1	1
Melbourne, 2b.	3	1	1	1	1	2	0
Swan, 3b.	4	0	1	0	4	3	1
Trowbridge, ss.	4	0	1	1	1	2	0
Scanlon, p.	4	0	0	0	2	2	0
Totals	36	10	6	8	27	13	2

OAKLAND GAS LIGHT AND HEAT COMPANY

	AB	R	BH	SB	PO	A	E
Smith, 3b.	5	0	1	0	2	2	0
Agnew, 1b.	4	0	0	0	10	1	2
Pingree, lf.	4	0	2	0	2	0	0
Hinds, c.-cf.	4	0	1	0	4	0	0
Millot, c.	2	1	1	0	2	1	0
Steel, cf.	1	0	0	0	0	0	1
Weber, p.	4	0	3	0	0	1	0
Crocket, rf.	3	0	0	0	1	2	0
Pape, 2b.	4	1	1	0	4	2	0
McGowan, ss.	3	0	0	0	2	1	6
Totals	34	2	9	0	27	10	9

RUNS BY INNINGS

S. F. G. & E. Co.	1	2	3	4	5	6	7	8	9	
Runs	5	3	2	0	0	0	0	0	0	10
Hits	2	2	1	0	0	0	0	0	1	6
Oakland G. L. & H. Co.—										
Runs	0	0	0	0	0	0	2	0	0	2
Hits	0	2	0	1	0	1	3	2	0	9

SUMMARY

Two-base hits—Barthol, Trowbridge, Hinds; first base on balls—off Scanlon 1, off Weber 6; struck out—by Scanlan 3, by Weber 3; left on base—S. F. 6, Oakland 8; double play—Smith, Pape, Agnew; first base on errors—Oakland 2, S. F. 6; hit by pitcher—Swan, McGowan.

He was a colored preacher, and with a worried look on his face he approached the counter clerk with the request that he would like to see him privately for a moment. The counterman from the expression on the darky's face, sniffed mystery. "What I wants to know, suh, am dis; do the gas company give any special rates foah gas used in committing suicide? "You see, boss, hits this away. I'm the preacher of the Holy Ghost Colored Church, and I done got a fool brother, whose name am White, but he 's blacker moah ways than one. That man's gifted with some terrible appetite for gin. Now, suh, yesterday I done have to go to Oakland to preach. Fore I goes, I struggled with that fool man to give up that gin business and be converted. He give in—done give in—and I left him surrounded with glory. When I returns this moahing I discover that when that gin worked itself out, that fool person attemps a near-suicide by trying to swallow all the gas you folks could make. I would have forgiven him if he had been in real earnest, but he done left the window open a little bit at the top, and when I thought he was dead, he jest waked up as if he disliked to be disturbed. Now, Lordy, when that bill done come in, I 'll be almighty distressed, and dat aint all, suh—aint all—I'm skeered that nigger done gone and got an appetite for swallowing your gas."

Told at Forty by An Employee

THINGS look different—at forty. I know, for I am writing this on my fortieth birthday. Life isn't any more serious than it ever was—perhaps it is less so. Surely, it is nothing like as much of a problem. Surely, too, it is more comfortable.

You see, I am an employee—one of the millions who get pay envelopes from somebody or somebody else every so often.

I have always been an employee, and suppose I always shall be. Somehow, there doesn't seem to be enough employing to do for all of us to have a chance at it. Besides, most of us don't know enough to do employing, yet nine-tenths of us feel that we are superior to the men who pay us, and we criticise their methods and their action.

Not openly—more 's the pity. I believe the average employer would be glad to hear decent criticism, decently made.

I have had three jobs since my twenty-first birthday—four years, seven and eight years.

To do better each time? No—to do worse, from a money standpoint.

But to apply some of the things I learned in the previous job.

I did get my wages increased occasionally while at the first two jobs.

But I would n't have gotten a worth-while promotion in a thousand years.

Why? Do n't ask me—just read over again the first part of this talk.

Eleven years to learn something—not much even then—of my duty as an employee.

And—I also learned not to lay any particular stress on my employer's duty to me.

Because he really does n't owe me any duty—unless my work and conduct are such as to impose an obligation upon him, in which event he 'll be glad to "square up."

I have said that I am an employee. And yet I have spent the last eight years of my life woking for myself.

Just as surely as though I owned a business.

How? By doing the best I know for my employer, every minute of my working day.

It 's easy—when you get into it.

I tumbled to the fact that there is only one fellow in the world who can help me or hinder me.

That fellow is myself.

He hindered me for a good many years.

He 's helping me now.

Some folks say I made a wonderful jump to where I am.

They 're wrong. I 've gone up slowly—very slowly, it has seemed sometimes.

In obedience, however, to the law of business gravitation—the law that inexorably says "up" if you 're worth it, and "down" if you're not.

I have n't worried about my job since I got the real hang of things.

Once, when I had a good offer from another city, my employer simply said, "I would like you to stay here."

Not a word about advancing my wages to meet that offer.

Not a word for six months after—for I stayed.

Then—that much, and more.

Some of the other fellows said harsh things about that man.

Just as I said them about former employers.

And they are listless, and uninterested, and jump when the bell rings.

Sometimes they tell me I 'm lucky—when there is no such thing as luck.

They have not learned—some of them are 'way past forty, and never will learn.

I 'm not a sentimentalist—I believe that "business is business" all around.

I 'm happy in my work; my digestion and my nerves are good. Life is beautiful, and richly worth living.

QUESTION BOX

Ask questions. Any one of the several thousand men and women in the Pacific Gas and Electric Company who wishes information pertaining to any phase of the company's work or concerning matters of common interest to residents of any section reached by the company's lines is urged to use this department freely. Send your questions to the magazine. There will be no charge.

Question.—Transmission lines are constructed with aluminum and copper conductors. Which is the most satisfactory?

Answer—Copper is the most satisfactory for many reasons, a few of which are:

1. Aluminum cannot be soldered thereby rendering it difficult to make a good electrical joint.
2. Aluminum is more readily attacked by the elements, permitting an electro-chemical action to take place especially when in contact with other metals.
3. Aluminum being comparatively soft is liable to chafe on the insulator which weakens the conductor.

E. H. S.

Question.—On what are the costs of rights of way for electric transmission lines based?

Answer.—A certain width of right of way running through the length of property and figured on an acreage basis, the number of poles or towers on the single piece of property, and per lineal foot without width of right of way. E. B. HENLEY.

Question.—How often should consumers' meters be tested to insure accuracy?

Answer.—There is no set time. The S. F. Co. is gradually getting down to a three-year period for complete substitution by new, or renewed, meters. Meters have been in active use for twenty years and proved out within 2% at the end of that time. In Wisconsin it is legally required that no gas company shall allow a gas meter to remain in service for a longer period than three years without being checked up for accuracy and readjusted if inaccurate. In the First District of New York gas meters are allowed to remain in use for seven years without being tested. The shorter the periods that elapse between the corrections of gas meter inaccuracies the greater the benefit that will inure to the company. *As a rule, the longer meters are in use the greater the probability of their registration favoring the consumer.*

C. L. B.

Question.—What is the meaning of "candle power" in the statement, "a 20 candle power gas?"

Answer.—Gas which, when burned at the rate of five cubic feet per hour, (temperature of air 60° F. and barometer at 30″) will give a light equal to twenty times that of a standard sperm candle weighing one-sixth of a pound and burning 120 grains per hour. W. R. M.

Question.—Why is it important to regulate the pressure on street mains?

Answer.—To maintain uniformity of operation of gas burners and appliances. If the pressure is too low or too high, results are unsatisfactory.

W. R. M.

Question.—What are the causes of unaccounted for gas in a distribution system?

Answer.—Loss at leaky joints and services.

Loss due to leakage when making service connections and extensions, and repairs to mains.

Loss due to condensation in mains.

Loss at street lamps when the burners consume more than their rated amounts.

Loss due to inaccurate meters.

Loss due to difference of temperature of gas at consumers' meters and at the works. W. R. M.

Question.—What is the correct method of connecting a gas service to a main?

Answer.—To a small wrought iron main by a tee cut into the line.

To a cast iron main my means of a tee in case of a large service; by a street ell tapped into the main when the service is small compared with size of main.

To a high pressure main by means of a saddle.

In all cases it is well to use a flexible connection; e. g., two street ells commonly called a "swing joint."

W. R. M.

Question.—Will a four-inch pipe deliver more or less gas than two 2-inch pipes, the pressures being the same?

Answer.—More because the area of a four-inch pipe is four times the area of a two-inch pipe.

Discharge varies directly as the fifth power of the square root of the diameter; therefore the four-inch pipe will deliver 4.45 times as much as a two-inch pipe, and 2.225 times as much as two 2-inch pipes.

W. R. M.

Question.—What is the formula for the flow of gas in pipes?

Answer.—Pole's formula is as follows:

$$V = 1350\, D^2 \sqrt{\frac{P\,D}{S\,L}}$$

V=Discharge in cubic feet per hour.
D=Diameter of pipe in inches.
P=Pressure in inches of water.
S=Specific gravity of gas (Air=1).
L=Length of mains in yards.

1350 is a constant which has been determined by experiment. W. R. M.

Question.—How do sharp turns in a pipe affect the amount of gas delivered?

Answer.—By the absorption and partial destruction of the kinetic energy of the gas; also by establishing eddies and increasing friction.

It has been determined by experiment that the resistance offered is least where the radius of the bend is equal to five times the radius of the pipe.

W. R. M.

Question.—How is the size of a meter determined to be set at any given location?

Answer.—The demand may be learned by an inspection of burners and appliances, and meters set as follows:

Cu. Ft. per hour Required.	Size of Meter Required.
170	5 Lt.
370	10 "
450	20 "
625	30 "
750	45 "
1300	60 "
1500	100 "
2000	150 "
2500	200 "

A colored sport who is proprietor of a saloon near the S. P. depot, came to the counter not long ago with the demand that the meter be immediately removed from the saloon to the backyard. When asked for a reason he at first said, on account of fire. Being assured that he need have no apprehension from that source, he replied, "Well, suh, I'll confide in you why dis hyuh request of mine am so earnest. You know whut dis hyuh meter box of yourn done to me? No? Well, I'll tell you what he done do to me one night last week. Down in my neighborhood there was a hold-up, and we all was talking bout it and what we 'd do in just such an emergency. After the boys done left my place, I shut the doah and goes over to the cash register to fix things foah the night. Just as I look in that drawer I hyah 'Click, Click.' I draps 'hind that bar and reaches foah the ice pick, jest then I hyahs 'Click, Click' once moah. Now I ain't fraid no real game, but I ain nevah hearn tell of sech a thing as a gun what clicks foah times and don't go off. More'n dat, I doan want no ghostly clicking round my head two o'clock in the morning, and jest as my face was changing from black to light brown, I hyahs that click, click once moah; then all of a sudden it done come to me that that clicking business am yonder gas calculator. Now, I ain't fraid no fool gas meter, but, believe me, your bills scare me as much as I want to be scared without that ghostly 'Click, Click' business. You move him or some night you find that meter box jes' up an' bus' hisself to pieces. S. A. W.

The Janitor Protests

It is a custom at a certain public school down in Maine for the teachers to write on the blackboard any instruction they desire the janitor to receive.

The other morning the janitor saw written: "Find the greatest common divisor."

"Hullo!" he exclaimed. "Is that darned thing lost again!"—*Lippincott's.*

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The Pacific Gas and Electric Company

SUPPLIES

LIGHT, HEAT, AND POWER

TO

Place.	Population.
Agua Caliente	50
*Alameda	23,383
**Albany	800
‡Alta	200
Alvarado	200
Amador	200
Antioch	3,000
‡Auburn	2,050
Barber	200
**Belmont	600
Belvedere	350
Benicia	2,500
**Berkeley	40,434
Big Oak Flat	150
Biggs	750
Black Diamond	500
Brentwood	200
Brighton	100
Broderick	500
‡Brown's Valley	50
**Burlingame	5,000
Byron	200
Campbell	1,000
Cement	1,500
‡Centerville	20
Centerville	500
**Chico	13,000
**Colusa	2,700
‡Colfax	400
Colma	500
Concord	1,500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Davenport	1,000
Davis	750
Decoto	350
Dixon	1,000
Dobbins	50
Drytown	100
Durham	500
‡Dutch Flat	400
**Easton	500
**East San Jose	1,500
Eckley	20
Emerald	50
Elmhurst	2,500
Elmira	150
El Verano	100
**Emeryville	2,000
Encinal	20
Fairfield	800

Place.	Population.
**Fair Oaks	250
Fitchburg	250
Folsom	1,500
*Fresno	35,000
Glenn Ellen	500
Gold Run	100
Grafton	350
†Grass Valley	7,000
Gridley	1,800
Groveland	50
Hammonton	500
Hayward	4,000
Hollister	3,000
Ione	900
Irvington	1,000
Jackson	2,000
Jackson Gate	50
Larkspur	950
Lawrence	100
Kennedy Flat	50
Kentfield	200
‡Lincoln	1,500
‡Live Oak	200
Livermore	2,250
‡Loomis	150
Los Altos	200
Los Gatos	3,000
Mare Island	500
Martell	25
Martinez	5,000
**Marysville	6,250
Mayfield	1,500
**Menlo Park	1,500
Meridian	300
**Milbrae	300
Mill Valley	4,500
Mission San Jose	500
Mokelumne Hill	150
Mountain View	2,500
**Napa	6,000
†Nevada City	4,000
Newark	700
‡Newcastle	600
New Chicago	25
Newman	1,000
Niles	800
**Oakland	150,174
Oroville	2,500
Orwood	50
Pacheco	200
**Palo Alto	6,000
‡Penryn	250
Perkins	200
**Petaluma	6,000

Place.	Population.
Peyton	250
**Piedmont	2,000
Pinole	1,500
Pleasanton	2,000
Port Costa	600
**Redwood City	3,500
Richmond	10,000
Rio Vista	200
‡Rocklin	1,050
Rodeo	100
‡Roseville	345
Ross	900
***Sacramento	52,000
San Andreas	200
San Anselmo	2,500
San Bruno	1,500
San Carlos	100
**San Francisco	416,912
**San Jose	40,000
San Leandro	4,000
San Lorenzo	100
**San Mateo	7,000
San Pablo	1,000
**San Quentin Prison	1,600
**San Rafael	6,000
Santa Clara	8,000
Santa Cruz	10,000
**Santa Rosa	8,000
Saratoga	200
Sausalito	3,000
Sebastopol	2,000
Selby	100
Sonoma	1,200
South San Francisco	2,500
Stanford University	2,000
Stege	100
‡Stockton	25,000
Suisun	1,200
Sunnyvale	2,000
Sutter Creek	2,000
Tiburon	100
Tormey	150
‡Towle	200
Tracy	1,200
Vacaville	2,500
**Vallejo	12,000
Vallejo Junction	10
Walnut Creek	350
Warm Springs	200
Wheatland	1,400
Winters	1,200
**Woodland	3,500
Yolo	350
**Yuba City	1,900

*Gas only; **gas and electricity; †electricity, gas, and water; ‡electricity and water; ***gas, electricity, and street-car service; unmarked, electricity only.

Service Furnished	Number of Towns	Total Population
Electricity	158	1,089,790
Gas	33	988,900
Water	17	43,415
Street-Car	1	52,000

EMPLOYS 3,500 people
OPERATES 11 hydro-electric plants in the mountains
3 steam-driven electric plants in big cities
18 gas works

SERVES ⅔ of California's population
27 of California's 56 counties
An area of 32,431 square miles
⅗ the size of New York state
½ the size of all the New England states combined

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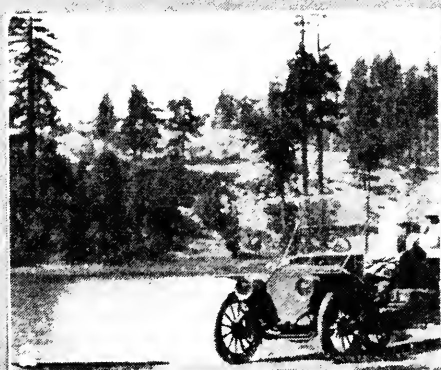


1—Emigrant Gap and Railroad Snow Sheds.
2—Crystal Lake.
3—Close by the Snow Sheds, near Cisco.
5—Donner Lake.
8—Type of country near Slippery Ford.
9—On the road to Riverton.

See Road Map, Sacramento to Tahoe by Automobile, page 415

PACIFIC GAS AND ELECTRIC MAGAZINE

VOL. II APRIL, 1911 No. 11

Incandescent Gas Street Lighting

By F. VICTOR WESTERMAIER, Philadelphia.

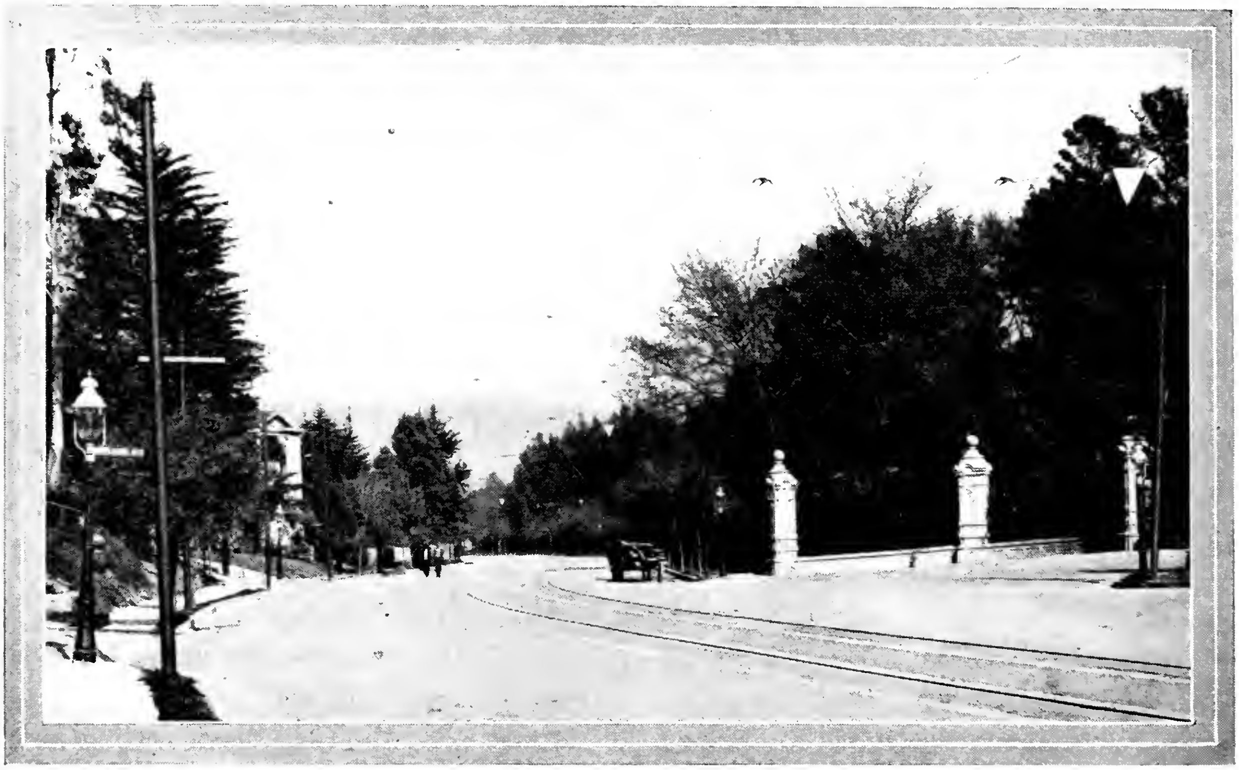
STREET lighting not only as a present day necessity, but as a means of promoting business and social intercourse, is recognized and appreciated by all civilized communities. As such, its development should be in keeping with the demands and in accordance with certain physical qualifications to produce the necessary results.

It is, of course, impossible to equal daylight illumination with any form or combination of modern illuminants, but by the proper application of those units combining the essentials necessary for visual efficiency, a satisfactory approach to that standard may be obtained. These are, generally speaking, color, diffusion and intrinsic brilliancy—the illuminant combining these, as they are combined in diffused sunlight, stands out as the ideal one for the lighting of streets.

The combination of the various elementary colors in diffused sunlight, produces a natural effect on the eye without fatigue or alteration of the natural changes taking place therein. Investigations have shown the effects of various colors in the discernment of objects, and the chemical changes produced by them in the eye itself. Any radical departure from the relative proportions of the elementary colors combined in daylight or the presence of such rays as the ultra-violet, is not only confusing, but harmful.

The diffusion of light during the day is practically constant, but the intensity of illumination varies with the altitude of the sun. Automatically, the eye adjusts itself to meet this variation and since the change is gradual no discomfort is experienced. On the approach of darkness the retina enlarges, a condition making the eye extremely sensitive to sudden changes in illumination brilliancy. Obviously, for effective night illumination, such variations should be eliminated as much as possible, making uniformity one of the cardinal requisites of proper street lighting.

In connection with uniformity is the matter of adequate illumination which should be determined by the character or the class of street to be lighted. Business streets on which there is considerable traffic, require a high degree of illumination to bring out, distinctly, moving and stationary objects so that the eye can rapidly receive its impressions. Less frequented streets should have lower intensities but sufficiently high to show the character of the streets, buildings and moving objects. Objects are visible by reason of the reflection of light from their surfaces. Consequently the street lighting unit should diffuse an adequate quantity of light in all general directions, not only along, but at some distance above the street level. In this respect street lighting is different from interior or directed lighting.



Wellsbach Double Invert Gas Lamps in Oakland.

Glare should be avoided in street lighting as much as greatly varying degrees of intensity. It is one of the characteristics in artificial illuminants most difficult to avoid and is experienced most in the case of high candle-power electric units because of their high intrinsic brilliancy. Being almost continually within the field of vision the dazzling effect on the eye of such illuminants is against the fundamental conditions of good street lighting.

Continuous efficient service is absolutely necessary in street lighting at all times regardless of weather conditions. Units must be practical, positive in operation and should be independent of one another. Careful maintenance and rigid inspection are important factors, since darkened streets, caused by light failures, are a menace to public safety. Furthermore, the units should be attractive and in keeping with the surroundings.

Wherever careful investigations have been made into the relative merits of gas and electric units for street lighting the former have demonstrated their superiority over the latter. In color, diffusion, distribution of light and low intrinsic brilliancy the incandescent gas mantle possesses qualities closer to those of diffused daylight than any other illuminant. Its practicability and economy for street lighting purposes is established by the preponderance in numbers of gas units over electric in all countries and by the fact that high candle-power gas units have been designed which are taking the place of electric arcs where a high degree of intensity is required.

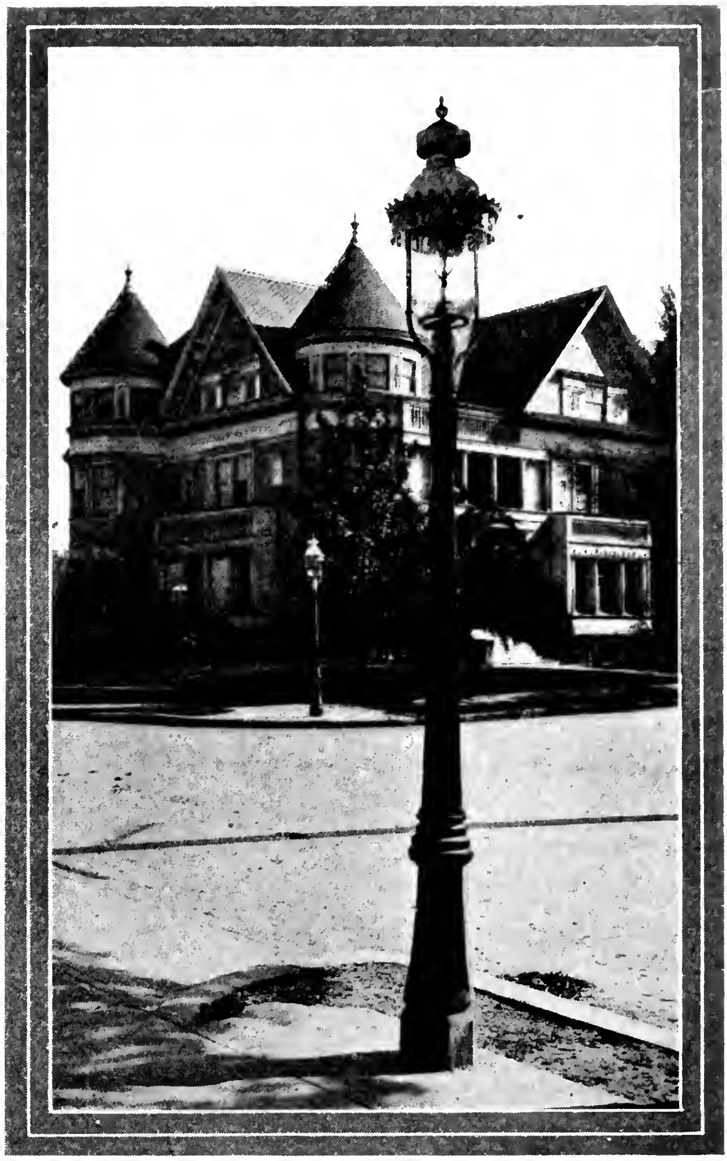
An idea of the extent of the use of incandescent gas lamps in some American and European cities can be formed from the following:

	GAS.	ELEC. ARCS.
Greater London	126,999	8,825
Paris	50,815	1,944
Berlin	45,424	
	2,500 High Pressure.	
Vienna	33,023	1,735
Hamburg	25,000	
Greater New York	52,073	
St. Louis	22,395	
Washington	10,379	
Baltimore	8,678	
Buffalo	8,291	
Kansas City	8,439	

The proportion of electric arc units to incandescent gas units in some European cities is as follows:

	ELECTRIC.	INCANDESCENT GAS.
Greater London ...	1	17
Perth	1	11
Glasgow	1	22
Dundee	1	62
Aberdeen	1	20
Edinburgh	1	9
Leith	1	9
Manchester	1	220
Bradford	1	141
Liverpool	1	22
Brussels	1	29
Cologne	1	25
Dresden	1	25
Vienna	1	19
Paris	1	26

Travelers through Europe have returned to America commenting on the superior street lighting and the greater degree of uniformity obtained abroad. The foregoing figures show the reason why this is true. The character of the American incandescent gas unit is equal, if not superior, to the European, but here they appear in fewer numbers and spaced farther apart than is considered consistent for good results abroad.



Gas Street Lamps, Oakland

A comparison of the color values of the various forms of street illuminants with diffused daylight, made by Dr. Herbert E. Ives, shows the marked superiority of the incandescent gas lamp. The values obtained by him are as follows:

SOURCE.	RED.	GREEN.	BLUE.
Average daylight	100	100	100
Sunlight, 2 to 5 p.m., Aug. 19, '08	100	91	56
Carbon arc, d. c.	100	69	42
Flaming arc	100	36.5	9.0
Tantalum incandescent, 2.00 watts per candle	100	49.0	8.3
Tungsten incandescent, 1.25 watts per candle	100	55.0	12.1
Welsbach gas mantle, ¾% cerium	100	81.0	28.0

From the above it will be noted that the color of artificial lighting with the Welsbach mantle is not materially different from late afternoon sunlight, whereas with the other types the relative portions of the elementary colors differ greatly. Consequently, in point of color, the incandescent gas mantle qualifies for effetcive street lighting.

The distribution of light from the source, as a center, is different in gas and electric units. In street lighting, having units spaced at some distance apart, the distribution of the light from each should be such that the rays of maximum intensity extend outward to meet those of the other units, maintaining a con-

stant degree of intensity along and for some distance above the street surface. For this purpose the characteristic distribution of light in the vertical plane of the incandescent gas unit is especially effective. Within a zone of 10 to 20 degrees about the horizontal are emitted the rays of highest candle power. Below this zone the intensity decreases reaching a minimum directly beneath the lamp. The unit being placed on the top of a post, the radiations are unobstructed in the horizontal plane making such distribution uniform.

In contrast with the gas lamp, the electric arc directs its maximum rays of light downward at an angle of about 45 degrees with the vertical with a much lower degree of light emanating in the horizontal direction. The effect of this is to produce a zone of high illumination close to the unit and very little illumination as the distance away from this zone increases. The contrast of the different degrees of illumination is very marked and since electric units must be widely spaced, owing to economy, uniformity of illumination is practically impossible in the degree obtained by gas units.

The following candle-power values in the vertical plane of the two units can be plotted to show the possibilities of each unit in producing uniformity of street illumination.

INCANDESCENT GAS LAMP Consumes 3.4 cu. ft. per hour.		ELECTRIC ENCLOSED ARC 13 M. M. 485 watts—6.25 amps.	
Horizontal	76.5	Horizontal	296 c.p.
5 Bel.	75.0	10 Bel.	294
10 "	74.6	20 "	340
15 "	73.8	30 "	338
20 "	72.5	40 "	369
25 "	68.2	50 "	411
30 "	63.2	60 "	361
35 "	58.5	70 "	244
40 "	53.0	80 "	54.5
45 "	47.5	90 "	32.5
50 "	42.5		
60 "	34.6		
70 "	24.5		

A practical demonstration of the greater uniformity of street illumination by incandescent gas units than by electric is obtained from the results of tests made in Washington, D. C., by the Electrical Testing Laboratories, April 28th to 30th, 1908. The measurements were made of the horizontal illumination at the street surface in each test cited, and are as follows:

TYPE OF UNIT.	ILL. IN FT., CNDLS., MAX.	MIN.	AV.	AV. VARIATION FROM MEAN IN PER CENT.
Test No. 4, magnetite arc	.380	.005	.062	106.6%
Test No. 5, series enclosed	.177	.003	.036	106.9%
Test No. 16, Tungsten series	.021	.007	.013	33.1%
Test No. 18, mantle gas	.044	.016	.028	24.8%

Magnetite arcs—3 ampere series magnetites in middle of street, lamps 21 feet above street level and 394 to 408 feet apart.

Series enclosed—D. C. series enclosed, 6.6 ampere, globes opal inner and clear outer. Lamps on poles along center of street between car tracks, 21 feet high and 394 to 397 feet apart.

Tungsten series—5.5 ampere tungsten series lamps equipped with radial wave reflectors. Lamps in center of street between car tracks placed at intervals of 100 to 105 feet apart and 16 feet above street level.

Mantle gas lamps—Clear glass chimneys and globes (no reflectors). Lamps staggered on opposite sides of streets from 115 to 125 feet apart and 8¾ feet above street level.

From these tests it is seen that with the electric units a much lower minimum illumination is produced than with the gas. As compared with the magnetite arcs and the series enclosed arcs, it is seen that the minimum illumination is respectively one-third and one-fifth of that where gas lamps were used. The greatly varying degree of intensity of illumination produced by the electric arcs of 106.6% and 106.9% compares unfavorably with the small variation produced by the gas lamps of only 24.8%. Visual efficiency certainly is not obtained when the eye must adjust itself within short distances to illumination intensities ranging from .005 foot candles to .380 foot candles; the maximum

being seventy-five times greater than the minimum. Such a result and effect is the direct opposite of the uniformity so necessary for good street lighting.

It has generally been conceded, in America at least, that for higher intensities of illumination the electric arc, because of its high candle power as a street unit, should be accepted. This is not the case in Europe, where direct comparisons have been made of the highest gas and electric units. One of the important and most travelled streets in Paris, the Rue de la Paix, is an example of high uniform illumination by incandescent gas units. Posts carry three lanterns each of the regular type, placed seventy-five feet apart on each side, produce adequate illumination for the heaviest traffic.

Berlin, after several years of careful observations and tests, is replacing all electric units with high-pressure gas units ranging from one thousand to forty-five hundred candle power. The results of these investigations have demonstrated that not only is higher uniform illumination obtained by means of the gas units, but also the general effect is more pleasing and accomplished at less cost. The needs of the various important candle power units according to the class of street are as follows:

1st class	4,500 c. p. units
2d class	2,000 " "
3d class	1,000 " "
4th class	500 " "

Residential and semi-residential streets are lighted by units ranging from 60 to 150 candle power.

Keeping pace with Berlin in street lighting are other European cities. London has recently converted numbers of its electrically lighted streets to high pressure gas, while all its residential districts are lighted by single and double burner low pressure incandescent gas lamps.

High candle power gas units have marked advantage over electric units, for effective street lighting, because of their lower relative intrinsic brilliancy. Because of this we find

it possible, as in Berlin, to have 4,500 candle gas units only $16\frac{1}{2}$ feet above the street level without causing the annoyance experienced when electric units are so placed. The following table of intrinsic brilliancies of various illuminants shows the position of incandescent gas in relation to different types of electric units.

	CANDLE POWER PER SQ. IN.
Candle flame	3 to 4
Kerosene lamp	4 " 8
Welsbach gas mantle	20 " 25
Acetylene flame	75 " 100
ELECTRIC UNITS.	
Enclosed arc, a. c.	75 " 100
Enclosed arc, d. c.	100 " 500
Incandescent filament, 3½ watts per candle	375
Tantalum, 2 watts per candle	750
Tungsten, 1.25 watts per candle	1,000
Flaming arc	5,000
Sun on horizon	2,000
Open arc lamp	11,000 to 5,000

Units of low intrinsic brilliancy cause little or no glare when properly spaced, consequently the full effect of the light source can be utilized efficiently, whereas, in the case of high intrinsic brilliancy diffusing screens or globes must be interposed, thereby reducing light and efficiency.

Diffusion of light might be termed an element of intrinsic brilliancy. The very structure and shape of the incandescent mantle causes complete diffusion by radiation from large numbers of surfaces.

Infallibility of service is more assured with gas units than with any other form of street lighting. First of all, a constant supply of energy or fuel is provided by reason of gas storage holders, which makes the service independent of boiler, engine or other mechanical troubles. The units are not dependent on any automatic mechanism in themselves. A broken or burned-out filament in an incandescent electric lamp in series with others may cause an entire district to be plunged into darkness, whereas a broken gas mantle still gives a quantity of light and does not interfere with the operation of other lamps.

No other system of street lighting receives the inspection and maintenance of incandescent gas lighting. Each unit is inspected twice daily—when lighted and extinguished; failures are reduced to a minimum, and when they occur are often the result of local accident. As an example of comparative efficient service the report of the Department of Public Works of Buffalo shows that during the year 1909 the average daily outages of electric arc lamps were 9.91 lamps per day out of a total of 3,050, and of the incandescent gas lamps, an average of 5.56 lamps per day in a total of 6,442 burning. In percentages of "outs" this becomes, for electric arcs, 0.325%, and for gas, 0.0863%.

The correct solution of any municipality's street lighting problems cannot be obtained without due and proper consideration of the incandescent gas units. It is possible that in

Outside Gas Arcs in Vallejo

America gas companies are not yet prepared to install the special gas mains required for high pressure gas units to light important business streets, but in localities where lower units are desired, there can be no doubt of the superiority and advantages of gas units over any electrical unit.

A recent development in the standard type incandescent gas lamp of this country is the application of a specially designed inverted burner for street lighting. To produce the best distribution of light and high diffusive qualities, two inverted mantles are employed. This change produces a unit of 140 to 150 candle power instead of 60 to 80, with an increase in gas consumption from 2.00 to 2.50 cubic feet per hour. In its other characteristics it has the same good qualities so firmly established in the regular type. Its polar candle power curve in the vertical plane is as follows:

HORIZONTAL.	130.0 c.p.	30 Below...	151.0 c.p.
5 Below...	138.0 "	35 " ...	150.0 "
10 " ...	148.5 "	40 " ...	148.5 "
15 " ...	155.2 "	45 " ...	140.0 "
20 " ...	154.6 "	50 " ...	135.0 "
25 " ...	158.5 "	60 " ...	132.5 "

Consumption, 5.50 cu. ft. of gas per hr.

Placing these new units on both sides of the street at the proper distance apart, and two units on a single post at street intersections will give high value street lighting.

American cities should keep up with European cities in street lighting as in other things. Careful consideration of the essential features necessary for good results should show conclusively the fallacy of using the glaring electric arc indiscriminately and also the placing of incandescent electric units of high intrinsic brilliancy in the field of vision.

Incandescent gas street lighting will advance in this country as it has abroad, because it has the distinct advantage of possessing all the necessary qualifications for reproducing the natural lighting effects of daylight.

To Our Employees

In Which Class Is Your Office?

The indifferent or discourteous employee of a gas company came in for such unanimous disapproval by the speakers at the last National Commercial Gas Association, that if any are long left to encumber their positions it won't be the fault of that organization.

Fresh from this meeting and with this subject still well in mind, the writer chanced to have business taking him to the offices of competing electric and gas companies in a fairly representative American city of medium size. In the former the cashier's desk seems to have been hastily devised with the sole intent of providing a narrow window through which money could be passed. A line-up outside the window was more or less patiently waiting the conclusion of a discussion between the cashier and another employee concerning some matter of office routine. Finally one of those in line called out, "Say, have you got time to take a man's money, I've been here long enough. The cashier consented to come forward but tartly rejoined, "You've been waiting just three minutes by the clock." The next one following was held in suspense till the young lady had investigated and probed for a sliver she suddenly discovered in her finger. In the room was an elaborate display designed to prove by meter the economy of some electric bulbs, but not a pleasant glance did it get from the exasperated customers.

How different in the gas office, a large, handsomely appointed room fitted up like a bank. The busy cashier was helped by an assistant at the next desk, and at the first evidence of congestion one of the treasurer's force at an adjoining desk pleasantly invited waiting patrons to come to him.

Result was many of those who had been promptly waited on strolled around amongst the fixtures and appliances and were evidently noted as prospects for early sales.

Courtesy, prompt service, attractive offices are certainly assets of value.—*The Gas Arc.*

Gas and the Barrel

By H. P. PITTS, Industrial Engineer.

H. P. Pitts

If one is of a practical turn of mind, he is apt to wonder, upon viewing a show window of a furniture store, where all of the oak comes from which goes into furniture; again, if he were to visit a barrel manufacturing plant he would probably forget the furniture and attempt to figure out where all of the oak came from that the whiskey and wine barrels were made from, and if he saw all of the empty barrels he would wonder—well, perhaps he would know. This latter industry might not have come to the observation of the writer had it not been for the untiring efforts of the New Business Department, which department has demonstrated, after months of experimenting, that gas forms almost as important a commodity in the manufacture of barrels as does oak.

Thinking that it would be interesting to know just how a wine barrel is made, a visit was made to the plant of Herbert Vogel and Marks Company, on Seventh Street, San Francisco. Here everything is rush and bustle; a barrel in its manufacture has to go through the hands of twelve different men before it is complete; and from the time that the staves are set up to the time that the last hoop is pressed into place, it is on the go without stop, excepting where the gas comes into play; then there is a short rest of three minutes, then on again. Everything goes like clockwork—it has to in order to turn out a barrel every two and one-quarter minutes. Each man knows every part of the process, for if he gets a little ahead he jumps in and helps the man next to him, for there must be no stoppage anywhere.

The staves are brought into the factory already sawn to length with the edges planed smoothly, and are piled in order in one corner. The heads come already turned to shape, ready to be set into the barrels, and are stacked up in the most convenient place.

Commencing with operation number one: A man takes the required number of staves and stands them on end in a form, having previously placed two heavy iron rings in place in the form; the last stave is forced tightly into place, and when taken out of the form resembles a deep tub which has lost its top hoop—all of the staves fitting closely at one end and held by two iron rings, and the other end all flared. Man number two then takes it and places it in a "steamer" for several minutes, which process makes the wood flexible, so that the flaring end may be drawn up tightly by means of a flexible wire rope being placed around it, and being drawn up by a small hand winch and another heavier iron ring placed on this end. These two processes are shown in Fig. 1.

Process number three is what is considered one of the most important, in that by the use of gas a new departure is made, which works most successfully and overcomes many obstacles heretofore experienced with wood or oil as fuel. It seems that for certain reasons, all whiskey barrels in manufacture have to be charred inside; whether or not this is done in order to permit the whiskey to preserve its strength to char another type of barrel, we are not informed; at any rate, whiskey barrels are charred inside. Wine barrels, while put through the same process, are not permitted to reach the charring stage, but are "heated." Now take your foot off the rail, please, and observe Fig. 2.

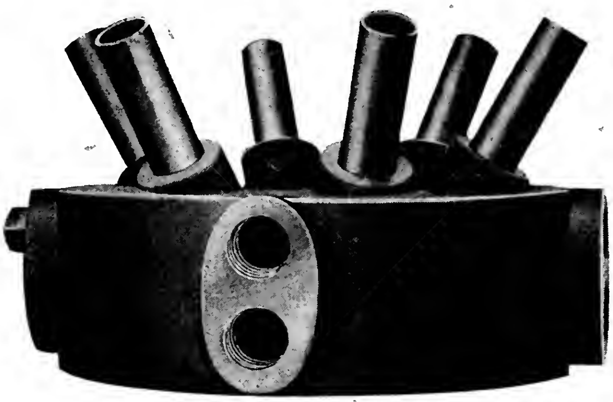
Seven "ovens" are seen; each oven consists of a flat base plate a little larger than the diameter of the barrel, in the center of which is set a circular Bunsen gas burner. The gas is mixed with compressed air and

FIG. 1 FIRST STEP IN BARREL MAKING

FIG. 2 CHARRING INTERIOR OF BARRELS BY THE NEW GAS PROCESS

FIG. 3 FINISHING EXTERIOR AND PUTTING ON THE HOOPS

forced through this burner. Compressed air is furnished by a small compressor electrically driven. The barrel is set on the base and the gas flame burns up inside of it, heating it. Over the barrel hangs a large sheet iron "hood" lined with asbestos, and made as



Gas Burner used for charring interior of barrels

nearly heat-proof as is possible; this hood is counterweighted and is drawn down over the barrel to retain the heat; three minutes does the work.

Up to a few months ago fuel oil or wood was used for this purpose, and was thought to be the only methods for heating and charring until gas was applied. The advantage of the latter over the former is that it can be distributed equally among any number of burners and is, therefore, more uniform, that is, it is always on tap when wanted, all danger from burning oil is eliminated, gas is so very much cleaner, quicker and easily regulated, and that the cost per barrel runs about one cent for heating, which is no higher than the cost for oil.

The equipment for the new gas process is very simple to install, as very few new parts are required to convert from the old process, and all such parts can be purchased at the gas appliance houses. The "Gas Company" will undertake the installation and will guarantee the success of the process where its gas is used. The burner is shown in another cut.

Process number 4. The two end rings are adjusted, so that the barrel may set centrally in the crozeing machine. In this machine the barrel revolves horizontally. Two "heads" with knives attached revolve on the inside edge on both ends of the revolving barrel and cut the groove into which the heads are set. This process, which we will call number five, takes less time than a minute per barrel. When finished a lever is thrown over, and the barrel drops out and rolls along a pair of "ways" to the man who bores the bunghole, which is process number six. He turns the barrel over to a man who puts in one of the heads, which is process number seven.

Process number 8. The barrel is now passed to a man who presses on the first permanent hoop and knocks off the first heavy iron ring; this same man then turns the barrel up on the other end and puts in head number two and permanent hoop number two. The barrel now has both heads in, bunghole bored and a hoop on both ends, but the outside is still in a rough state. It rolls along to number nine (this is the boss himself), who puts it in a horizontal position in a form of a lathe (shown in the foreground in Fig. 3), and with a lathe tool resembling a small hand plane, "turns" off the outside and makes it smooth. It drops from this lathe and rolls over to man number ten, who, as shown in the foreground of cut number 3, with the aid of a hoop driver, puts on the remaining hoops.

The barrel is then ready for testing. It goes across the yard where it is washed out with Nevada soda and hot water, tested for leaks, which, when found, are plugged up; then the finished product is stocked away until the market calls for it—from appearances there is quite a demand for them. Where do they all go to?

It is nice work and requires intelligent men to do it; each man does his part on time, and does it well, too, for one might stand and look on all day and see every barrel come through to the test—without a flaw, ready for the market. Once in a while a hoop will break while being pressed on, but it is replaced in a second. Of the other several

machines operated are the hoop-making machines which make the hoops from the straight band iron.

The whole factory is operated electrically, thereby doing away with the necessary expense of boiler and engine, long line-shafting, and danger of fire. You will have to look a long way to find a more progressive firm, for all of the machinery is kept up to date and in good repair, and their every endeavor is to turn out a finished product which will stand against the strongest competition.

Stockton City Water Front

In an interesting article by A. C. Oullahan, recently published in the Sacramento Bee, he gives the following statement:

On Stockton Channel within the City limits there are—

4,485 lineal feet of water front.
4,865 lineal feet on McLeod's Lake.
7,000 lineal feet on Mormon Channel.

16,350 total lineal feet.

Of the 4,485 feet on Stockton Channel, 3,234 feet is improved with a concrete bulkhead, or sea wall.

The City owns all the water frontage.

The income from the frontage for the year 1910 was $11,236, for tolls and rentals.

Every year a portion of the revenue is set aside for adding to the concrete bulkhead, and in a few years it will all be lined with concrete.

In 1910, $2,191.25 of the revenue was used to wipe out the last vestige of $40,000 bonds, issued in 1891 for Channel improvements.

The City tolls are three cents per ton for each boat registering 150 tons or under. For those registering more than 150 tons, one and one-half cents per ton for the first 150 tons, and three-quarters of a cent for each additional ton.

Rentals for permanent wharf space, 25 cents per lineal foot occupied, per month.

The illustration on the front cover of this issue is from a photograph taken from the roof of the new Hotel Stockton, at the head of the channel.

J. W. Hall,
Manager, Stockton District.

From Sacramento to Lake Tahoe and Return by Automobile

By ERNEST B. PRICE, Department of Operation and Maintenance.

E. B. Price

It was my good fortune to be one of the guests of Mr. F. C. Martens, Assistant Cashier of the Farmers and Merchants Savings Bank of Oakland, last summer on a vacation trip from Sacramento to Lake Tahoe, and the following data and information has been published in the hope that it may be of service to those of our readers who desire to make this trip. The photographs have been numbered according to the order in which they were taken, as indicated on the map, and have been selected from a number, in order to show the character of the country through which we passed.

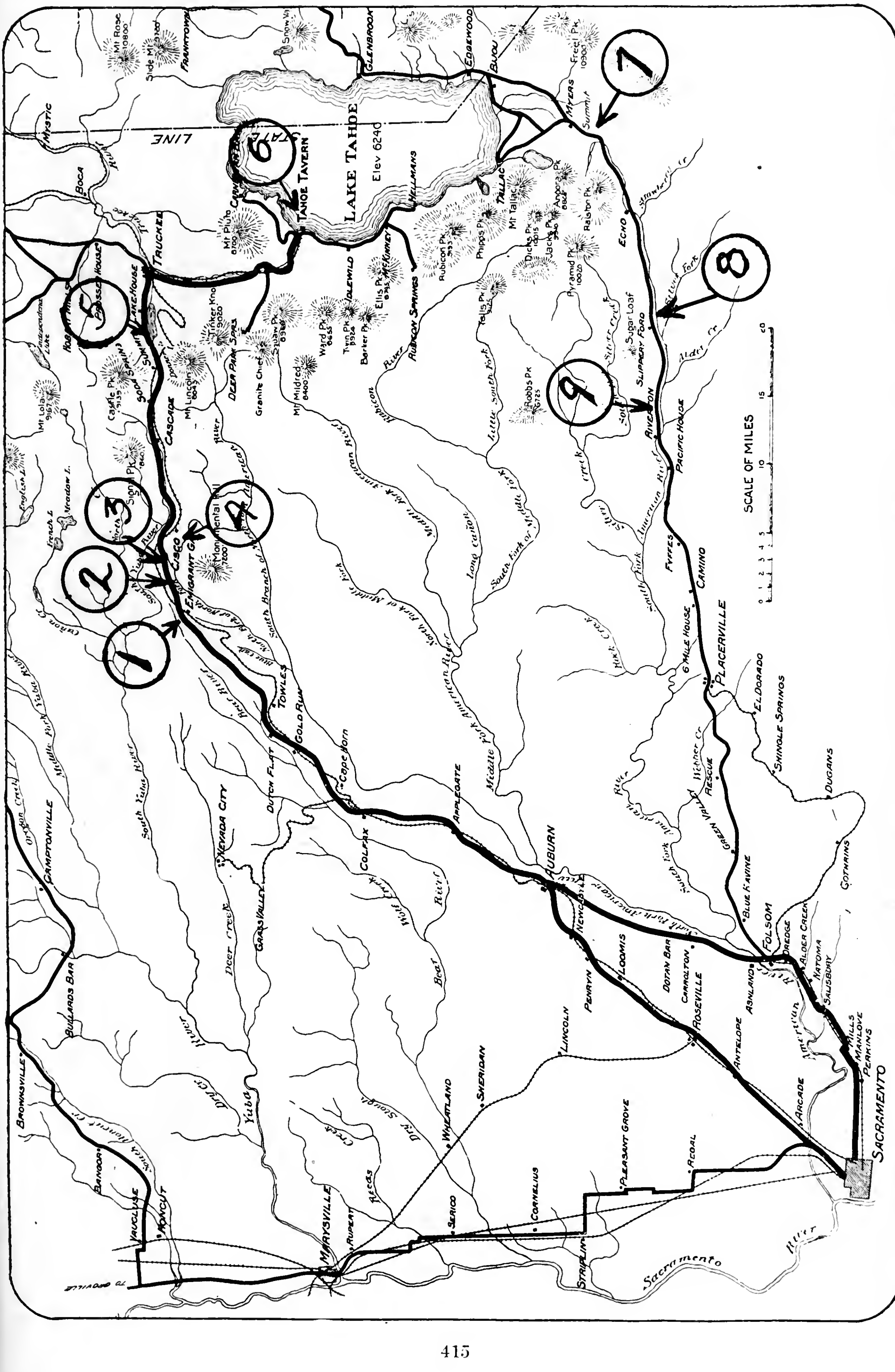
A complete description of this beautiful country would convey but little to the minds of our readers, because the grandeur of it all cannot be reduced to mere words, and we will only offer a few suggestions, and trust that the map and data may be filed for reference.

From Sacramento, we would suggest making the run to Cisco in a day, remaining there over night and make the Tahoe Tavern the next day. By this means, more time may be taken to see this splendid country between Cisco and Truckee, and the ride down by the Truckee River is well worth while.

4. Tire trouble near Cisco

Instead of going back over the road to Truckee, we shipped the machine on a barge down the lake to Tallac. However, it would be even better to ride down the west shore of the lake to McKinney's, and take the barge from there to Tallac. We spent a most enjoyable three days at Tallac, and then followed the south fork of the American River on the return trip to Sacramento. This river is truly a fisherman's paradise, and it was hard to refrain from stopping the machine at every tempting pool. At Riverton, we were obliged to stop on account of tire trouble; but spent a very pleasant evening at this typical little mountain hotel, and got a good start in the morning. The only mishap we had on the trip was the breaking of a front spring at Alta. This was repaired by means of a piece of scantling and baling wire, and it carried us safely through to Tahoe Tavern. We took a carefully selected supply of pro-

6. On the Bridge at Lake Tahoe


LAKE TAHOE
Elev 6240
TAHOE TAVERN
TRUCKEE
CISCO
EMIGRANT GAP
TOWLES
GOLD RUN
DUTCH FLAT
COLFAX
APPLEGATE
AUBURN
NEWCASTLE
PENRYN
LOOMIS
ROSEVILLE
FOLSOM
PLACERVILLE
CAMINO
PACIFIC HOUSE
RIVERTON
ECHO
MYERS
TALLAC
EDGEWOOD
GLENBROOK
MARYSVILLE
SACRAMENTO
SCALE OF MILES

visions, in order not to be entirely dependent on hotels, should we desire to stop at some pretty spot on the road. Good accommodations can be reached every night at some point on the road, so that it is not necessary to take any camping equipment. Take plenty of warm clothing in the way of sweaters, etc., for even in August we found the morning and evening air cool in the mountains. Our car was a thirty horse-power, four-cylinder Stevens-Duryea.

7. Last view of Lake Tahoe

MILEAGE RECORD—SACRAMENTO TO TAHOE.

DATE.	PLACE.	DISTANCE BETWEEN TOWNS.	DISTANCE FROM SACRAMENTO.	TIME OF ARRIVAL.
Friday, Aug. 12,	Sacramento....	..	..	....
	Folsom	22	22	8:00 a. m.
	Auburn	18	40	9:35 a. m.
	Applegate ...	11	51	11:20 a. m.
	Colfax	9	60	12:15 p. m.
	Gold Run ...	11	71	2:15 p. m.
	Dutch Flat ..	2	73	2:30 p. m.
	*ALTA	1	74	5:10 p. m.
Saturday, Aug. 13, 5:45 a. m.	Crystal Springs (just below Alta)	2	76	....
	Emigrant Gap.	12	88	8:25 a. m.
	Cisco	9	97	11:00 a. m.
	Summit	13	110	1:40 p. m.
	Donner Lake..	2	112	2:15 p. m.
	Truckee	9	121	3:30 p. m.
	TAHOE TAVERN	16	137	5:30 p. m.

**Front spring broken on curve near Lake Alta.*

NOTE:—In place of doubling back over the trail to Truckee and then going into Nevada and following the eastern shores of Lake Tahoe, we shipped our machine on a barge down the Lake from Tahoe to Tallac. On the return trip Sacramento is used as a base for distances. The reader will note, therefore, that these distances constantly decrease as we approach Sacramento from Tallac, instead of increasing as in the foregoing table.

MILEAGE RECORD—TALLAC TO SACRAMENTO.

DATE.	PLACE.	DISTANCE BETWEEN TOWNS.	DISTANCE FROM SACRAMENTO.	TIME OF ARRIVAL.
Thursday, Aug. 18, 9:30 a. m.	Tallac	..	116	....
	Myers	11	105	10:20a . m.
	Summit	4	101	11:00 a. m.
	Phillips	2	99	11:30 a. m.
	Riverton	25	74	3:55 p. m.
Friday, Aug. 19, 8:15 a. m.	Riverton	..	..	....
	Pacific House..	5	69	8:45 a. m.
	Camino	11	58	9:35 a. m.
	Placerville ...	8	50	10:05 a. m.
	Green Valley..	11	39	12:00
	Folsom	17	22	1:20 p. m.
	SACRAMENTO..	22	0	3:05 p. m.

Score One For Power Co.

From the *Woodland Mail*, March 8.

Everybody seems to consider it an inherent right to find fault with a corporation if any thing goes wrong. By the same measure a good word is their due when they come up to expectations. During the present week we have experienced the most severe storm of recent years, but through it all the Pacific Gas and Electric Company has kept its wires supplying power and light to Woodland intact, except for a short hour on Monday night. It shows careful attention to both local and main line conditions. A newspaper, at least, appreciates an uninterrupted current.

Where Some Would Have the Fair

They took a vote in Gasville,
  Among the bookkeepers there,
As to the site each wanted
  For the 1915 Fair.

Said Hyland: "Just a minute,
  Be sure and keep it dark,
I think the best place for the Fair
  Is in Idora Park."

Conens next expressed his choice,
  Said he: "You make me sick;
That Fair should be in Larkspur
  Where the mud and dust are thick."

Said Wrinkle of the Closings,
  As a fan he won some fame,
"Let us have it on a diamond
  With a continuous baseball game."

Said Wentz, who plays the 'cello,
  As he smiled serene and bland,
"Just put the Fair most anywhere,
  But let me lead the band."

Next Brearty spake his preference,
  As a hunter he 's not slow,
"I want the Fair on marshy land,
  Where the ducks fly very low."

McCarthy smoothed his golden locks,
  Said, as he cast his vote,
"Let 's put it on Goat Island
  And get everybody's goat."

" 'Golden Gate Valley' for mine,"
  Said Moon, "there crowds will follow,
And I will pulverize the man
  Who calls the place 'Cow Hollow'."

The next to vote was Donovan,
  Said he: "I'm not a yeller,
But I would like to see the Fair
  In one great big Rathskeller."

Fitzgerald said: "You take my tip,
  To do it up in style,
The Fair should be located
  Upon the Emerald Isle."

Then Collins had his little say,
  "I know a place that 's grand,
I 'd put your bloomin' Fair, old chap,
  In London, on the Strand."

Von Schlichting said: "For your big Fair,
  The place I like the most,
Is dear old Heidelberg, Ach Gott!
  And 'Unser Kaiser', host."

Then Angelo, the yachtsman,
  Said: "Boys, this is no "con,"
My motion is to have the Fair
  On the shores of Tiburon."

Said Boggs: "List, while I whisper
  The best place that I know,
You stick the Fair on Union Square
  So I won't have far to go."

Jim Murphy said: "You 'guys' are fierce,
  You 're all mixed in your dates,
It should be in a quiet spot
  Where there are no 'L' rates."

Bigué said : "Quit your 'kidding,',
  I 'd spoil nobody's plans,
The ideal spot for that World's Fair
  Is down at 'Coffee Dan's.' "

Said Gewirtz, who must reach for books
  Upon the topmost row:
"Please do not put it up too high,
  Short men should have some show."

Said Kavanaugh: "At the altar
  I 'd have 'My Lady Fair,'
And next November I 'll be sure
  To join the dear one there."

"In my opinion," Compton said,
  "So there 'll be no mistake,
At Electra I would place the Fair
On the banks of Tabeaud Lake."

"We 'll have that Fair," said Simpson,
  (Of the "Weeklies" he is clerk)
"Way over in some corner
  Where the boss can't see you work."

Then Haver said, with gentle sneer:
  "You fellows make me weep,
The Fair should be in Oakland
  Where we all can go to sleep."

Jack Willis, a subscriber
  To the Fund, said: "You can bet,
I care not where the Fair is put,
  If dividends we get."

The last to speak was Oldis,
  "You all have had your say,
Why bother where the Fair is held,
  So your 'Balance' is 'O. K.' "

Now every "bookie" has been heard,
  With more or less of gas,
The writer favors all the sites
  If he gets a season pass.

EUGENE A. BEAUCE.

Water System of Electra Power Division

By W. E. ESKEW, Superintendent, Electra Power Division.

W. E. Eskew

Twenty miles above the Electra plant we have a concrete developing dam across the Mokelumne River. Here 5,000 miner's inches of water are taken out and carried in the "Upper Standard" ditch along the mountain side to a point opposite the power house, where it empties into a small reservoir termed the "petty reservoir," whence we obtain a 1,467-foot head.

Another dam two miles below the first one supplies 2,200 inches of water to the "Lower Standard" ditch which follows a parallel course to the upper ditch until it reaches the large Tabeaud reservoir, two hundred feet below the small one, into which most of the water empties, some 500 inches remaining are carried to Sutter Creek, in a smaller ditch, through a system of small reservoirs, whence it is distributed to the towns of Amador City, Sutter Creek, and Jackson, and the several mines of Amador County.

From the petty reservoir or the upper ditch we have a large pipe-line leading to a receiver two hundred feet below, to which also a tunnel conveying the water from Tabeaud reservoir is connected. A pipe-line leading to the power house from this receiver furnishes water with which to operate two 5,000-kilowatt units under a 1,267-foot head.

From this receiver two other pipe-lines also extend from this reservoir to the power house and which ordinarily are operated under a 1,467-foot head, supplying water for the operation of five 2,000-kilowatt units.

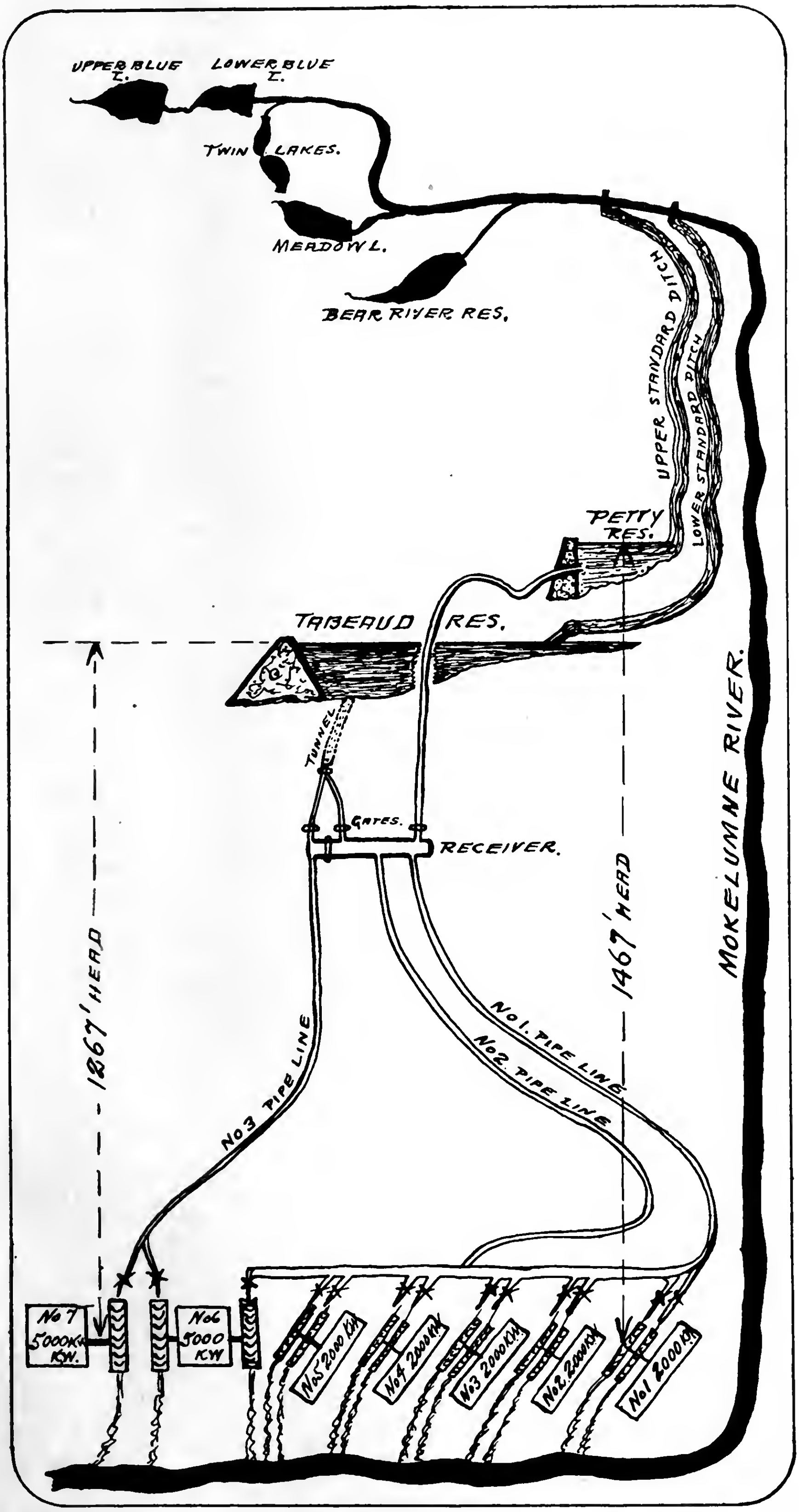
There are gates on this receiver so arranged that the pipe-lines can be operated on either the 1,267- or 1,467-foot head.

In case of a break on the upper ditch it is necessary to shut down the 2,000-kilowatt generators; then close the gate at the receiver, on the pipe-line feeding from the petty reservoir, and open the gate on the receiver leading from the tunnel. We are then enabled to operate the 2,000-kilowatt units with water from Tabeaud reservoir. This reservoir is of sufficient capacity to supply the plant for several days in case of trouble on the ditches.

In case the water arrives at the head of

Waste Water Chute and Flume on Upper Ditch, showing also Lower Standard Ditch

the pipe in the small reservoir on the upper ditch, and load conditions are such that we are unable to shut down the 2,000-kilowatt units, the water is then spilled from the small reservoir into the large one, by means of a flume, until the 2,000-kilowatt units may be shut down and changed back from low to high head.



Rough pen sketch of Water System of Electra Power Division, from inception at the Upper Blue Lakes to discharge into the Mokelumne River at the Power House.

In case of trouble on the lower ditch, the water is turned out, and is then spilled from petty reservoir on the upper ditch, into the ditch running to Sutter Creek, so as to furnish the towns and mines until the lower ditch has been repaired.

Sixty-five miles above the plant we have several lakes and reservoirs, from which water is drawn during the dry season to maintain the amount of water required to operate the plant. The water from these lakes and reservoirs follows natural water courses to the head dam on the Mokelumne River.

EDITOR'S NOTE.—The rough pen sketch reproduced on this page is an exact duplication of drawing received with this article, and while it is not drawn to scale, this cut furnishes an excellent idea of the entire water system supplying the Electra Power House.

Subscriber's Fund

By L. JENNINGS, Accountant, De Sabla Power Division.

IT IS with "a general honest thought of common good to all" that I attempt to present to those into whose able hands the initiative of creating that which I advocate, must of necessity fall—and most fortunately so, because of their peculiar fitness and capacity for such a work.

If in the right, I need not further champion this cause, than to present it to those, to whom the direction of one of the greatest companies in the world, as well as the futures of its thousands of employees, have been entrusted.

I find no clearer way of getting directly at the object in point, than to excerpt from a letter addressed by Mr. Samuel Insull, President of the Commonwealth Edison Company of Chicago, to the employees of that company, that which states with precision what I would present:

To the Employees of the Company:

The Board of Directors at a meeting held on June 15, 1909, adopted a plan for the creation of an Employees' Savings Fund, with a view to giving the employees of the Company an opportunity to become subscribers to the fund and through it to accumulate and ultimately invest if they so desire, a portion of their earnings in the Capital stock of the Company. Under the plan each subscriber shall pay into the fund during his subscription period, an amount equal to, or per cent of his salary as he may elect; payments to be made promptly as he receives his salary. The subscriber, or his estate, will receive at the end of his subscription period, all moneys contributed by him to the fund, with interest compounded semi-annually at the rate of six per cent per annum, whether the subscription period terminates at the end of five years, or because the subscriber leaves the Company's service or is discharged within that time. If the subscription period continues for the full five years the subscriber may, at his election, receive instead of the cash payment above mentioned, as much of the Company's Capital Stock as the amount of his cash payment will then purchase, if the selling price of the stock is then at or above par, or at the average market price during the two preceding calender months, if the selling price of the stock is then below par."

From an employee's standpoint, the establishment of such an institution would mean the systematic saving of a considerable proportion of his earnings, deposited with an organization created, controlled and operated by men known to him, and in whom he has perfect confidence, earning 6 per cent net, compounding semi-annually, in place of depositing his irregular, spasmodic savings, if any, in a savings bank earning three or three and an eighth per cent. Also the privilege of having his money thus saved, invested and re-invested by men for whose services, ability and judgment, few, if any, purely savings insituations could afford to pay. It would mean the actual possessing of a safe, earning investment, the assuming entity in the world of men who have things, the laying of foundations for something more than a hand-to-mouth existence—that for which—though not confessed even to themselves—nine out of every ten young men of today are living.

From the standpoint of the Company it would give them employees actuated by the most powerful incentive, personal interest—profit sharing, or as stated concisely in the Boston Consolidated Gas Company's statement, which in 1906 created an institution of this character, "to give employees of the Company an owner's or Share holder's interest in the business, thus affording to all employees a new motive for endeavoring to promote the prosperity of the Company and an opportunity to improve their pecuniary condition."

A primary consideration is whether or not an institution of this kind would be taken ad-

vantage of in a substantial way by the employees.

To avoid idle speculations and opinions on the matter, I submit a comparative statement of depositors and deposits of such an organization, the Stone & Webster Employees' Investment Association, created in 1902, by a "Declaration of Trust" by the several members of that well-known company:

DATE.	DEPOSITORS.	DEPOSITS.
January 15, 1903	204	$ 45,213.00
January 15, 1904	236	79,164.95
January 15, 1905	413	111,966.60
January 15, 1906	542	209,832.86
January 15, 1907	787	351,511.35
January 15, 1908	995	443,613.96
January 15, 1909	1,106	480,610.01
January 15, 1910	1,160	509,147.21

To establish the fact that such an institution is not only feasible but self-sustaining, I submit below for consideration, a statement of resources and liabilities produced at the end of eight years' operation by the same organization:

RESOURCES.

Bonds and Coupon Notes		$214,371.08
Preferred and Capital Stocks		259,010.50
Common Stocks		53,273.00
Cash		17,719.24
Notes Receivable		8,000.00
		$552,373.82

LIABILITIES.

Depositors' Accounts		$509,147.21
Special Accounts		4.87
Reserve		30,000.00
Undivided Profits for Dividends, Jan. 15, 1910	$11,321.69	
Balance	1,900.05	13,221.74
		$552,373.82

In closing, I submit the following for consideration:

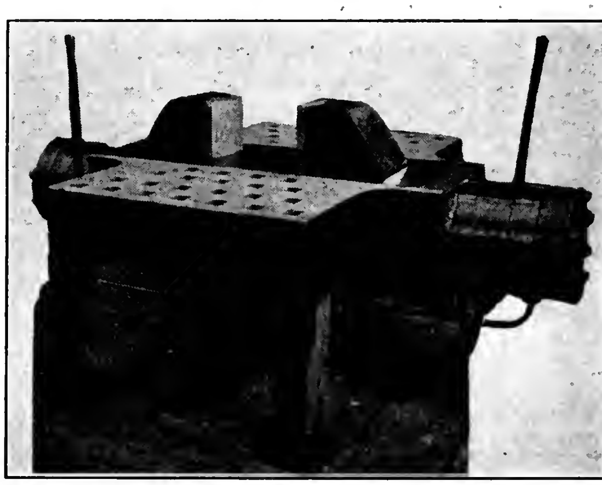
Would the existence of an organization of this kind benefit the community at large, by bettering and giving entity to those taking advantage of it—tending strongly to make them something more than month-to-month workers?

Would it not tend to draw to the service of the Company earnest, efficient men and women to whose vital importance would be the furthering and protecting of its prosperity?

And, finally, would it not tend strongly to make better citizens—people who voted intelligently—not one-sidedly, on blind, ignorant and vicious legislation, voters hampering, and in the future, still further to impede, entirely unnecessarily, any moves of a public-service corporation?

My object has been to bring to the attention of those with whom the power of action lies, as well as those who will reap the benefits, the fact that such institutions are in active existence; that they are substantially taken advantage of by the employees; that they are self-existent; and that the proof of their utility is perfectly manifested in their continuance and rapid growth. It is left to more able minds than mine to determine whether such an institution would further perfect that wonderful organization, the Pacific Gas and Electric Company.

The accompanying cut shows a small Hydraulic Press, of 1,500 pounds pressure, re-



cently installed by R. D. Wood and Company at the Mare Island Navy Yard.

This press has a flush table outside of the two punch horns, and is used for bending channels and other structural sections.

Electric Talks

VI.—The Storage Battery and Battery Connections

By JOSEPH P. BALOUN, Head Draftsman.

J. P. Baloun

Storage batteries are a form of chemical electric cells in which the electrodes are not dissolved by the liquid or electrolyte, but undergo a chemical change when supplying electric current. This chemical change is similar to that produced in a chemical primary battery, that is, oxygen is released from the positive and hydrogen formed at the negative electrode. This form of battery may be put in active condition and made to give out current by passing electric current through it from some other source; the flow of current to be in the opposite direction to that in which it flows from the battery. This process is called charging a storage battery and it is said to be discharging when it is supplying current.

Most of the commercial storage batteries are made up of positive electrodes of lead peroxide and negative electrodes of pure lead, (in a finely divided and spongy state) immersed in an electrolyte of diluted sulphuric acid, usually about one-third acid and two-thirds water. The frames for supporting the materials of the electrodes are of lead as they do not necessitate much mechanical strength. There are two recognized processes of preparing these lead plates. One is the Planté process, named after Gaston Planté, who in 1860 produced the first cell of this character; the other is the Faure process, named after Camille A. Faure, a French electrician. This latter process has a flat leaden framework adapted to hold the paste or pressed materials, of litharge and red lead, which has been moistened with weak sulphuric acid and them compactly pressed into the grid frames.

On charge and discharge the oxygen and hydrogen combine with the acid of the electrolyte. It will be noted that on charging a cell the inflowing current being in a reverse direction, the release of the hydrogen and oxygen takes place on the positive and negative elements or plates, respectively. As a sulphurous compound is abstracted from the sulphuric acid in the electrolyte, the condition of the solution is always more diluted at the end of the discharge of a cell than at the beginning. The electricity is not actually stored in a storage battery, it simply performs certain chemical work in acting on the materials of the electrodes or plates. It is therefore very important to expose as much of the lead surface to the action of the electrolyte as possible; this accounts for the use of perforated, checkered and grooved lead plates instead of using an ordinary flat sheet lead type of electrode. All of the positive plates in a battery are interconnected and the negative plates are connected likewise.

The voltage of the cells is about 2 volts, for, at the end of a charge the voltage is about 2.4 or 2.5 volts, and then falls very quickly to 2.1 volts when the cell begins to actually discharge. After this sudden drop a voltage of 2 volts is maintained over the principal discharge period of the cell. The voltage is not allowed to fall below 1.75 volts at the end of discharge.

The capacity of a storage cell depends on the exposed area of the plates. The ordinary unit of capacity is the ampere-hour. Thus an 80 ampere-hour cell is one which would supply 10 amperes continuously for 8 hours before requiring recharging. Manufacturers may make cells with a large or small number

of plates and vary the size in order to obtain any desired capacity value of a cell.

There are two very important factors in the use of the storage battery: firstly, after a cell is charged it can be moved to any locality and used either for stationary or vehicle work; secondly, these batteries are used in conjunction with a direct-current dynamo or generator, where, for example, the generator must furnish current for 1,000 lamps at one period of the day and 1,500 lamps at another. In that case the capacity of the generator is such that it can normally take care of 1,250 lamps, and at the time when it furnishes current for 1,000 lamps, the excess energy passes to the battery and stores itself in the form of chemical energy. Later on when the load is 1,500 lamps the battery furnishes current for 250 lamps and the generator supplies the current for 1,250 lamps. By the use of such a system the size of the generator is kept at a minimum, and although the current demand is variable, the load on the engine or motor-generator is constant. In electric railways the load is far more irregular, for, at certain times the cars are going either up or down hill and thus throwing additional load on or off the generating plant. These rapid variations of load are a feature of railroad work, and the storage battery is very useful in equalizing the moments of light and heavy loads.

To make the charge and discharge currents exactly equal to the change requirements of the load, as would be necessary in electric railway, elevator or other variable motor loads, a small dynamo generally called a "booster" is used. It is so connected as to automatically furnish the electro-motive force, or voltage, needed to help the battery when the load is in excess of the generator capacity. This booster also sends current into the battery when the load is light. This valuable feature of a reversible voltage for the battery or line demand is most important and is accomplished by the use of a booster with automatic controlling devices, or by the various automatic boosters now on the market.

It must be remembered that a storage battery cannot be charged from an alternating current, but that a direct current must be used. They may be charged from a 110 volt lighting main, as in Fig. 1, with a rheostat in the circuit, or as in Fig. 2, with a bank of lamps. An ammeter is shown

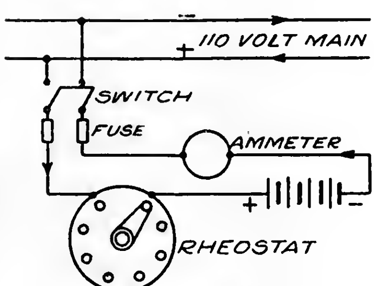


Fig 1

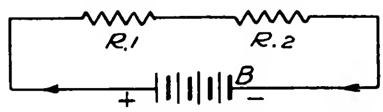


Fig. 3

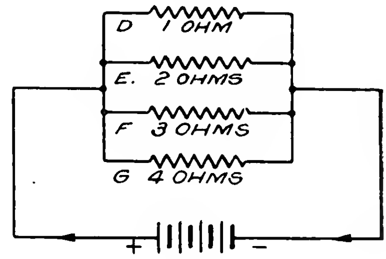


Fig. 6

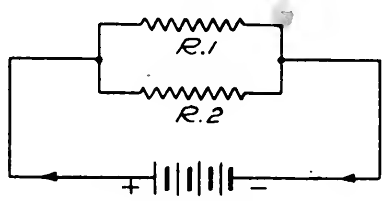


Fig. 4

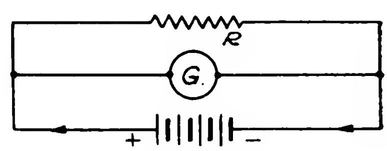


Fig. 7

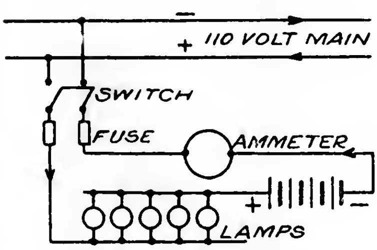


Fig. 2

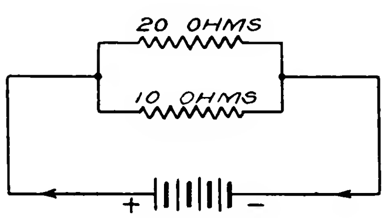


Fig. 5

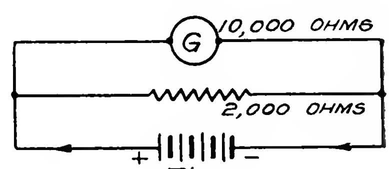


Fig. 8

therein, and although convenient is not essential. The rheostat or lamps serve to regulate the charging current. For since a 32 candle-power 110 volt carbon filament lamp has a resistance of about 110 ohms and will carry one ampere, just so can the charging current from the 110 volt main be limited to 5 amperes, by connecting five 32 c. p. lamps in parallel; or as a 16 c. p. lamp requires 5 ampere current, ten 16 c. p. lamps in parallel should be substituted.

Since the resistance of a circuit is the reciprocal of its conductance, it has been deemed advisable to take the unit of resistance an ohm, and spell it backward thus, mho, (pronounced moe), to create a unit of conductance, for example a wire having 10 ohms resistance has a conductance of 1/10 mho, or a wire having 1 mho conductance has a resistance of 1 ohm.

Representing a resistance and a battery graphically as R1 and R2 and B respectively in Fig. 3 and 4, then the total resistance of battery B Fig 3 circuit is equal to the sum of the resistances, which are in series. For if R1 equals 70 ohms and R2 equals 30 ohms, resistance equals 100 ohms. Though these resistances are unequal, the flow of current in amperes through them is the same.

In Fig. 4, the resistances are equal and connected in parallel, but in series with the battery; the joint resistance of which is equal to the value of a single resistance, divided by the number connected in parallel. For if R1 equals R2, then their conductance is also equal and the current will divide, one-half going through R1 and one-half going through R2. Since the area for the flow of the conducting current has been doubled, the joint resistance to its flow will be one-half of R1 or R2. And if there were four equal resistances in parallel, then the joint resistance cf the circuit would equal one-fourth the value of one of the resistances.

In Fig. 5 the two resistances are unequal, 10 and 20 ohms respectively, and are connected in parallel, then the joint resistance will be less than either one connected alone. The joint resistance of two unequal resistances connected in parallel is equal to the product of the resistances, divided by their sum; thus $\frac{10 \times 20}{10 + 20} = \frac{200}{30} = 6.66$ ohms joint resistance.

When more than two unequal resistances are connected in parallel, the joint resistance of two wires is first found, then using this value as a single resistance it is combined with a third wire and so on.

If a circuit has several resistances in parallel as in Fig. 6, so as to have a division of current in its branches, then the value of these branches in amperes of current is directly proportional to the conductance of the respective branches, or inversely proportional to their resistances.

If R1 and R2 in Fig. 4 are equal resistances and a current of 10 amperes flows through the battery, then 5 amperes will flow through each resistance; suppose R1 has a higher resistance than R2, then it would have a lower conductance, and the greater current would flow through the lower resistance R2, which has the higher conductance. If resistances D, E, F, and G, in Fig. 6, have 1, 2, 3, and 4 ohms respectively then their joint conductance will be $\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = \frac{12+6+4+3}{12} = \frac{25}{12}$ mhos. The conductance of D $= \frac{12}{12}$ mhos, of E $= \frac{6}{12}$ mhos, of F $= \frac{4}{12}$ mhos, of G $= \frac{3}{12}$ mhos. Then if a current of 50 amperes flows from the battery through these four branches, then the current through D $= \frac{12}{25}$ of 50 $= 24$ amperes, E $= \frac{6}{25}$ of 50 $= 12$ amperes, F $= \frac{4}{25}$ of 50 $= 8$ amperes, and G $= \frac{3}{25}$ of 50 $= 6$ amperes, giving a total of 50 amperes.

If 24, 12, 8 and 6 amperes of current pass through resistances D, E, F, and G respectively of Fig. 6, the electro-motive

force or difference of potential required to send these various currents through the branches would be equal to the sum of the currents of all the branches multiplied by the joint resistance of the branches. The joint conductance in Fig. 6 is $\frac{25}{12}$ or 2.083 mhos, so the joint resistance is $\frac{12}{25}$ or .48 ohms. Then $(24+12+8+6) \times .48 = 50 \times .48 = 24$ volts or the required difference of potential.

In Fig. 7 a galvanometer G is shown connected to the battery circuit. A resistance is also introduced at R as a shunt (or by-pass). This galvanometer is now said to be shunted. A galvanometer is an instrument for indicating or measuring a current by its own electro-magneto force. If the resistance of the galvanometer is 2 ohms, and of the shunt 2 ohms, then the flow of current through the galvanometer will be the same as through the shunt, both resistances being equal. If the resistance of the galvanometer is 5 ohms, and of the shunt 1 ohm, then five times as much current will flow through the shunt as through the galvanometer. In the latter case, the galvanometer readings must be multiplied by six to give the flow of current from the battery. By shunting a galvanometer or other instruments, such as ammeters and voltmeters (which measure the amperes and volts respectively) their range of indication can be increased. The multiplying value of a shunt is equal to the total current flowing through the circuit, divided by that flowing through the galvanometer; or the sum of the galvanometer resistance divided by the shunt resistance, plus one to the quotient. If as in Fig. 8, there is a shunted galvanometer which is of 10,000 ohms resistance, and the shunt of 2,000 ohms resistance, then the multiplier for the reading on the galvanometer scale is $\frac{10{,}000}{2{,}000} + 1 = 6$; the true value of the flow of the current must therefore be multiplied by six.

In discussing in a general way these chemical primary and storage (secondary) batteries for handling the flow of the dynamic electric current, it will no doubt be interesting to know that "live" batteries exist within many fishes and eels. In the Nile, Congo, Orinoco, Amazon and other rivers, electric fishes and eels are provided with powerful static electric batteries or "animal" Leyden jars. Nature has devised this electric weapon for the protection of these creatures, while the production, method of release and discharge of this current is a mystery to us. Upon the examination of some species it has been found that the so-called battery occupies one-third of the bulk of the fish. The internal arrangement of thousands of cells, each filled with a jelly-like fiuid, are connected together through an elaborate system of nerves which spread over the entire surface of cell plates. The computed area of the total surfaces of these plates in some fishes is from 50 to 60 square feet. In the six-foot long electric eels, the total superficial area of their battery is over 100 square feet. Some physicists have obtained sparks from these eels when in a confined tank. By using an air gap between adjustable needle points they have obtained as great a separation between terminals as one-fourth of an inch, with the high-tension static discharge from this "live" battery.

The Company sent a draft for some overtime work to W. H. Gray, formerly employed at the Alta Power House, but who is now attending college in Ohio. With the return of the check stubs the following letter was received:

"The checks came as a very agreeable surprise, and I assure you they are appreciated and will be used to advance the cause of education. When we hear so much about the greed and injustice of some of the large corporations, those who have had experience with the Pacific Gas and Electric Company cannot help but feel that this corporation does not belong in this class, and an instance of this kind tends to confirm that conviction."

MEN OF THE COMPANY

JOHN H. HUNT

IT IS not always the man with the loudest voice, nor the one most often seen in public places, that accomplishes in life the best results, both for himself and for the community in which he lives. It is an old saying that "Speech is silver, and silence golden."

It is the custom of corporations to select for positions of trust and honor, those who have demonstrated by their life, their ability to properly take care of the duties committed to them.

The officers of a large industry, handling many men and many articles of merchandise, in selecting a man to determine upon the means and methods of purchasing the goods required, must seek to obtain one who possesses, above all things, the one attribute of absolute honesty; this is the first prerequisite; there are others, without which mere honesty would be in a degree inefficiency, and that is knowledge gained by participation in it, of the world's markets, and with the exercise of practically that great gift of women, "intuition" to grasp the physchological moment when, in the ebb and flow of commercial commodities, goods can be purchased at the lowest prices. Discrimination must also be had of the kind of things to be bought, as best fitting the needs of others.

The Pacific Gas and Electric Company is fortunate in having as the Head of its Purchasing Department a man who possesses all of the above essentials for that particular department.

John H. Hunt, the Purchasing Agent, is one of those demure, modest men, never assertive of his own virtues and qualifications, who has been trusted with the wise expenditure of millions of dollars since his first connection with the Company. He it is who deals with the many thousands of sellers, and he it is who is the only buyer for the Company.

In the general biographical sketch which is requested of each of the Heads of Departments of the Company, as forming the foundation for such an article as this, Mr. Hunt has modestly given the following data:

Born March 19th, 1868, in the grand old commonwealth of Massachusetts, with grammar and high school education as his prepara-

tory school for the battle of life. At fifteen years of age he entered the employ of the Sutter Street Railway Company, San Francisco, and gradually advanced during twenty years with that company until he became Assistant Secretary.

On May 1st, 1903, he became the Assistant Purchasing Agent of the United Railroads. In February, 1905, he became the Purchasing Agent of the San Francisco Gas and Electric Company, and took the added duties of Purchasing Agent of the Pacific Gas and Electric Company in April, 1906. Married in 1895, he has two children, a boy and a girl.

Line 16 of the Biographical Data contains this question: "Detail any book or paper of which you are the author, where printed or read." His answer to that query are the letters "N. D.", which, I assume, in the vernacular of the Purchasing Department, means "Nothing Doing." He has, however, written his name to his credit in the records of the Corporation, and books of requisitions of which he has been the author remain as the evidence of his fame.

The Pacific Gas and Electric Company is proud of such men as John H. Hunt, and in the words of, perhaps, one of his progenitors, "more power to him."

Bits of Color Round th' Gas Counter

By CHAS. L. BARRETT.

Gas office incidents are often odd enough and filled with sufficient human interest to deserve some of the high sounding titles of the best six sellers were there a proficient chronicler at hand to write them up. Unfortunately the scribes are usually so very busy and the incidents so recurrent, that they do not find time for notes, even though they should notice unusual conditions.

Two such incidents happened in a single day recently; both were amusing, one was almost a tragic comedy.

The following description of them may be of interest:

A tall young fellow of heavy build and rather toughish appearance had laid his money and gas bill upon the Receiving Clerk's marble money slab, having previously rolled a cigarette and given the wrapper the last touches of salivary adhesion, carelessly struck a match upon the company's polished woodwork to light it. As he did so, a rather angular middle-aged woman, who also had a bill to pay, approached the window and espying the "coffin-nail" combination, quick as a flash, with the right forefinger poised fish-hook fashion, snatched Mr. Toughey's cigarette out of his mouth and threw it on the floor, saying in quick nasal staccato, "Don't you know that thing's got poison in it?" Well, —if you never saw a surprised individual, here would have been your opportunity. The young man was so "taken off his pins" that his instinctive resentment and disgust was aptly coupled in one short ejaculation: "Oh, shut up!" was all he said, gathered up his bill and change and walked out, casting behind him as he left one or two of the most expressively disgusted looks you ever saw upon the face of a human.

Pacific Gas and Electric Magazine

PUBLISHED IN THE INTEREST OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - - - EDITOR
A. F. HOCKENBEAMER - - - BUSINESS MANAGER

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445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. II APRIL, 1911 No. 11

EDITORIAL

THE THIRTY-NINTH SESSION OF THE STATE LEGISLATURE came to an end upon Monday, March 28th, 1911, and has gone down into history.

It has accomplished much in the way of Laws of Regulation, notably the submission of a Constitutional Amendment to be voted on at an election to be held in October, placing all public-service corporations under the administration of the Railroad Commission, without following, in that particular, the action of the State of Wisconsin, which some time since placed all public-service corporations in the hands of the then constituted Railroad Commission of that State, but with full power of regulation and control.

It has been obvious for a good many years to all thinking men engaged in the service of public-service corporations that proper regulation of corporations having privileges of supplying the community with transportation, light, heat, power, and water, must eventually be regulated by a Commission which will have full power, as well as ample time, to thoroughly investigate and legislate for such corporations.

The Constitution of 1879, as amended in 1884, gave that right to the several municipal bodies under the provisions of Article 11, Section 19, of the Constitution. This provision, giving any person or corporation, organized for the purpose, the right to use the streets of any municipality, subject only to the right of the municipality to fix the rate, has been productive of more damage to the State and its interests than was conceived of at the time of its adoption.

Its apparent main object at the time was to provide for competition and regulation, but it has signally failed of its purpose. The controlling bodies of the municipalities, confronted with the cares and general operation of a municipality, have never had time or knowledge to properly fix rates, and, as a consequence, the annual investigation of water and lighting companies has been farcical.

Rates have been fixed without reference to values of property. Courts are encumbered by suits brought by corporations in defense of their rights, which have put them on the defensive in protection of those rights, thus giving a tone of antagonism to the people. Rates have also been fixed, based upon party platform at the clamor of an uninformed and biased political party, seeking preferment by appealing to the prejudices of the masses.

It is to do away with these uncertainties, and to give justice to the people and to the companies, that Commissions in the several States have been formed.

In Massachusetts the Gas and Electric Commission has placed the business of the manufacture and generation of gas and electricity upon a firm foundation, and the securities of companies engaged in that business are classed among the best in that State.

The same effect has followed Commissions in New York, Wisconsin, and other States, and the institution of a Commission of this character in California would do more to settle the very unsettled conditions of investment than any other Act of the Legislature. It is unfortunate, however, that the law as proposed to the people is but an excuse for a Commission, and does not fully protect either

the people or the corporation. It proposes a battledore and shuttlecock game of playing the corporations according to the whim of the people, between the Commission and their own municipal government. Stability of trade and commerce can never be accomplished by any such means.

It was hoped that California would follow the trend of other States, of placing corporations absolutely within the power of an unprejudiced Commission, so that they would be compelled to render the full value of their commodities to the people at no more than reasonable remunerative prices.

The proposed law unfortunately leaves corporations in the same uncertain state of legislation, and has not in any way solved the vexed problem of regulation.

It can safely be asserted that all corporation men would welcome the institution of a proper commission that would have full power over the properties, in the determination of the value of the same, and would be content to accept a rate for service after such judicial hearing as can only be had before a Commission having such particular matters only in hand; but the proposed law would, if adopted, leave them in their present unsatisfactory condition, where investments are not only unprotected, but having no guarantee of stability are apt to be shy of the extensions so necessary to the growth of our great commonwealth.

Under instructions from General Manager, Geo. C. Holberton, dated March 16th, Mr. J. D. Butler, Auditor of the San Francisco Company, has been placed in control of the Bookkeeping, Collection, and Addressograph Departments of that Company, and will report directly to the General Manager, as regards the operation of those departments.

Effective April 1st, 1911, the Sebastopol Light, Power and Water Company will become a part of the territory of the Santa Rosa District, with Mr. M. G. Hall as manager.

The following letter is commended to all Managers as a good suggestion to follow:

Oakland, Cal., March 23, 1911.

Editor Pacific Gas and Electric Magazine:

Dear Sir: In the article by D. E. Keppelmann, entitled "How to Increase the Gas Output," published in the March magazine, it was suggested that solicitors make periodical visits to their consumers to adjust difficulties and show the company's interest in their welfare.

While that plan would undoubtedly tend to create a friendly relation between the company and the consumer, it would also throw a burden on the solicitor and take up time and energy which might better be devoted to converting "prospects" into "realities."

So far as I can see, the results sought after by the above plan could be obtained by having the collectors on their regular rounds inquire if there are any complaints. In case there are none, the proper spirit has been shown with no loss of time or extra expense. If there should be a complaint, the collector could jot down a memorandum of it and the consumer's name and phone number. These memoranda to be turned in at the office each night, and the next day attended to by the regular office complaint force. This plan offers two advantages:

First—It would impress the consumer with the fact that the company has more thought for him than just to present its bills promptly;

Second—It would relieve the solicitors of extra work, thus reducing expense, and would accomplish that, without proportionately increasing the work of the office or of the collector.

Respectfully submitted,

W. H. Pinkston.

The Company has just published a very elaborate and highly illustrated business album of 275 pages, divided into about 20 pages of a general write-up on finances of the Company, with statements of earnings, assets and liabilities, and the present bond issues of the allied companies, prepared by the Treasurer's office.

Another section of about 30 pages, issued from the office of the President, recites the history and furnishes statistics of the physical properties.

The balance of the book is devoted to individual and grouped photographs of scenes in all districts and divisions.

Fighting Snow

By W. E. MESERVEY

AS a large majority of those connected with the Pacific Gas and Electric Company are residents of the Bay Counties, and many of them have never seen any snow, perhaps an article giving some of the trials and hardships of the men whose duty it is to look after the ditches and keep them open during bad weather, will be interesting.

I do not know that I can make this article more interesting, than to give an account of the big storm of January 9 to 20, 1911, the effect it had on ditches, and the manner of handling them after they became blocked.

The storm commenced on the 9th with rain, and after a few hours turned to snow, accompanied by a terrific gale. The snow, which stuck to the trees, was very damp, and many of these after becoming weighted down were broken, falling into the ditch and over the telephone line. This impeded the running water and also cut off all communication, and it was two days before the lines were working.

On the 13th, a huge snowslide occurred above Bear Valley, coming from the high bluff above the flume, and carried six boxes into the river one hundred feet below. At that time, the snow had reached a depth of ten feet on the level, and it was still snowing. Lumber to repair the break had to be taken up the flume on trucks. It was necessary to keep the snow shoveled off to run the trucks, and to keep one man on watch so that the men could be warned in time to escape from their perilous position should another slide occur.

It required five days to repair the break, and during that time the main ditch, from that point to the big tunnel, a distance of fifteen miles, was completely blocked with snow, also the Cascade system of nineteen miles. At that time the snow was from ten to twelve feet in depth along the main ditch, and from four to seven on the Cascade.

Men were sent from Grass Valley, Nevada City and Washington, and arrived at Bear Valley on the 18th. It was very hard to get men as only those that could snow-shoe could be employed.

OPENING THE DITCH

In running snow out of the ditch, the workmen first shovel a trench about two feet in width through the snow in the ditch until they reach a spillway (these spillways are usually about one mile apart), then a small head of water, about five hundred or six hundred inches, is turned into the ditch. This is worked along until it gets to the spillway, when the men get into the ditch, break up the snow and run it out of the spillway. That section being cleared of all snow, the same method is pursued to the next spillway, and so on until the ditch has been cleared. It is necessary that the snow be all cleared from the ditch before commencing on a new section, as any snow left will run down and fill the trench and the work will have to be done over.

When it is snowing hard, work has to be suspended as the snow—or slush, as we call it—which is running, will block the ditch behind the workmen, and all that can be

done until the snow ceases is to keep the ditch open to the spillway where the water is wasting.

That the readers of the Magazine may have some idea of the amount of snow running in the ditch during a heavy snowstorm, I will state that on the 13th, when the storm was the heaviest, the slush in the Cascade ditch was one solid mass one foot in depth, that is, it covered the entire surface of the ditch a foot deep, moving with the water.

In my twenty-nine years of experience as a ditchman, I have never seen so heavy a storm as the one during January, 1911. The snow fell to a depth of ten feet on the level in sixty hours.

During the winter of 1890, there was a larger fall of snow, it being sixteen feet on the level along the line of the main ditch, but it extended over a much longer period, being from Christmas, 1889, to the middle of January, 1890 in accumulating that much.

The blockade of 1911 was raised in ten days, after the break at Bear Valley had been repaired, while in 1890 the main ditch was blocked from the middle of January to the first of April.

In 1890 the Cascade ditch was blocked for thirty-four days; while in 1911 it was cleared in eight days. The head of the Snow Mountain ditch was blocked for thirty-six hours, but only two miles were blocked. The last-named ditch receives the water from the north fork of Deer Creek. There being much spring water, this ditch seldom blocks.

The ditches were all cleared without any breaks or damage, and without any serious injury to any of the workmen.

In ditch work some strange things happen. For instance: after it had been raining for several days, eighty feet of the Chalk Bluff ditch slid away and no water had been in the ditch from the beginning of the storm. The storms of 1890 were not accompanied by heavy winds, while in 1911 the wind blew a gale. In 1890, each agent handled his section of ditch, while in 1911 all agents worked under orders of the foreman. Comparing the two winters, the writer thinks a record has been made for the year 1911 in clearing thirty-six miles of ditch in ten days.

Authorized Additions and Improvements

CHICO: Work has been commenced on the duct system, to provide for placing wires underground, as covered by city ordinance.

MARE ISLAND: Expenditure covering additions and improvements to this sub-station.

MARIN DISTRICT: Contract has been let with the General Electric Company covering 5,000-kilowatt turbine of the Curtis type, which will be in service this summer.

MARYSVILLE POWER DIVISION: Reconstruction of Bay Line No. 3 from Yuba River Crossing for a distance of twenty-three miles.

NORTH TOWER DIVISION: Construction of telephone line from North Tower to Vallejo.

OAKLAND: The installation of an additional 1,000-kilowatt motor generator set at Station "H".

Contract has been let with the General Electric Company for additional 15,000-kilowatt turbine of the Curtis type, which will be in service to take care of next winter's load.

An eighteen-foot extension with reinforced concrete front for Station "H".

Certain of the transformers now in Station "B", Oakland, will be removed to Station "H", and the 60,000-volt Bay Lines will terminate in Station "H", and an 11,000-volt line will extend from Station "H" to Station "B", and a second 11,000-volt line will run from Station "H" to the Temescal Substation. This will remove all high-voltage transmission lines from Oakland.

REDWOOD DISTRICT: Purchase of a two-ton electric truck for the use of this district.

Extension of a 4,000-volt, three-phase line from Redwood City to Woodside, at an approximate cost of $11,000.

SACRAMENTO: The purchase of a 700-pound wagon to be used in the selling and distribution of lamps.

Contract has been let with the General Electric Company covering 12,000-kilowatt turbine of the Curtis type, for installation at the new steam station at Sacramento, and which will be in service to take care of next winter's load.

SAN FRANCISCO: Purchase of an automobile drip wagon for use of the Gas Department.

Purchase and installation of a storage battery and building to accommodate same on lot adjoining Substation "D".

Purchase of an additional automobile for use of Steam Section of O. & M. Department.

SOLANO POWER DIVISION: Reconstruction of cement substation, and increasing the transformer capacity by adding a bank of 500-kilowatt transformers.

WOODLAND DISTRICT: An extension of our lines in Yolo County to supply service to the town of Knights Landing.

The new sub-station building at Livermore is completed and in operation, replacing the wooden structure erected several years ago by the Standard Electric Company.

This station is a substantial concrete building, constructed with the idea of making it thoroughly fire-proof in every respect.

All switches are located in separate concrete cells and isolated so far as was possible from the other apparatus in the station. In making the change the low-tension voltage was increased from 2,300 to 11,000 to allow the Livermore Water, Light and Power Co., who distribute in the territory, to take on additional business at the gravel pit near Remillarde, and the Spring Valley Water Company's pumping plant near Pleasanton.

The old sub-station building is being fitted up for living quarters for employees of the local distributing company.

George Jackson Vincent

IN the October, 1909, issue, there appeared a splendid likeness of Zacheaus Floyd, who had been for 41 years and 2 months continuously in the service of the Gas Company, San Francisco.

Mr. George J. Vincent, similar to Mr. Floyd, had up to the time of being placed on the pension roll, July, 1909, served the Company well and faithfully for 33 years and 5 months.

Mr. Vincent was born in Birmingham, England, October 21st, 1836, and is now well on his way to the 75-year mark. He was first employed in England as a silversmith's assistant and traveling salesman, coming to the United States in 1869, and located in Idianola, Texas. He removed to New Orleans, where he was in the hardware business, and then to Tangipahoa, Louisiana, where he bought a plantation and became a cotton planter. He came to San Francisco in January, 1876, made the acquaintance of Mr. Jos. G. Eastland, then Secretary of the San Francisco Gas Light Company, either through a letter of introduction or as a member of the same church, the Episcopal. Mr. Eastland found an opening for him with the Gas Company, February 25th, 1876, as meterman's helper, from which position he was shortly transferred to that of bookkeeper upon the consumer's ledgers, his prediliction being more in that line, writing a splendid hand. Mr. Vincent was probably the best penman the Company ever had in its permanent employ. He subsequently kept the gas service and consumer's deposit ledgers, made up the dividend books and stock journals, arranged and took charge of the daily meter reading system, and then worked upon the consumer's ledgers again. He afterward became Superintendent of the Closing Bill Department, and in 1907 was placed in charge of a newly organized Stationery Department of the combined corporations, Pacific Gas and Electric Company and the San Francisco

Gas and Electric Company, under Mr. R. J. Cantrell. He was retired on pension July, 1909, and at the present time is enjoying a well-earned rest with one of his sons, who resides in Portland.

Mr. Vincent's home life has always been ideal. After many years of married happiness, his wife passed away in 1903. There were born to them eight children, four of whom are living; two of these are married, and there are five grand-children, whom it is the great pleasure of their grandpa to visit.

George, Jr., one of the principals of the Cardinell-Vincent Company, San Francisco, lives in Berkeley, and has three children.

Sidney, Correspondent Agent of the Associated Press of the Northwest Territory, resides in Portland, and has two children.

Violet and Millie, daughters, keep house for their father in San Francisco.

Mr. Vincent, during all the years of his active service, was a zealous, conscientious worker for the Company, was of excellent ability, fightingly loyal at all times, and in general, a man of splendid, strong character and good attainments.

PERSONALS

A joint meeting of the District Managers, Superintendents and Departmental Heads was held in the Assembly Room, 445 Sutter Street, Saturday, March 18th. Mr. Britton presided.

Mr. F. F. Barbour, the new Assistant to the President, and Messrs. Ray, Southerland and Hall, recently appointed District Managers in Martinez, Antioch and Santa Rosa, respectively, were introduced to the other members.

Many interesting matters were threshed out at this meeting. The Chairman announced that the next joint meeting would be held in San Francisco, during the month of April.

Mr. George Scarfe, Superintendent of the Nevada Power Division, left for an extended trip through Europe, Thursday, March 23d. Mr. Scarfe has had a very strenuous season in his division the past winter, on account of the severe storms in the mountainous section, over which he has supervision, and is now availing himself of a well-earned rest.

Mr. F. E. Cronise returned from an extended trip throughout the East, Sunday, the 19th. Mr. Cronise went East on a business trip for the purpose of securing new ideas in relation to the New Business Department, of which he is head.

Mrs. E. B. Lilly, wife of Mr. Lilly, in the San Francisco Auditing Department, is the mother of a fine baby boy, born March 9th, 1911. This news is especially interesting, when we recall that Mrs. Lilly was formerly Miss Quin, the popular head of the main telephone exchange in the San Francisco office of the company.

In a small building constructed in the early fifties, which has since successively been a store, saloon, bank, church, and lastly, after some reconstruction, headquarters for a small power plant, was born one William Arthur Crabbe. 'Twas the early morning of February 24th, 1911, that William for the first time aroused the sleeping inhabitants of Horse Shoe Bar. Horse Shoe Bar is about thirty miles east of Auburn and six miles west of the once uproarous mining camp of Bogus Thunder. What a setting! What an opportunity for a Bret Harte or a Robert Service! As it is, William must make his own history. He has our sympathy, however, for if he inherits the maternal qualities of courage and ambition, combined with the paternal attributes of determination, energy and industry, poor William has a strenuous life before him.

The father, W. J. Crabbe, will be remembered by many of the company's employees as having taken an active part in construction work at De Sabla, Colgate and Station "C," Oakland.

To Mr. and Mrs. Crabbe we extend our heartiest congratulations and assure them that, although their first-born has not yet made history, he has done much for geography, for Horse Shoe Bar and Bogus Thunder are now on the map.

JAS. H. WISE.

Mr. F. H. Varney, engineer O. & M. Dept., who left for an extended trip throughout the East, February 11th, returned to San Francisco March 21st, and reports that he had a very enjoyable and interesting trip.

H. J. Waters, storekeeper for the Santa Rosa District, returned on the 22d from a

ten-days' trip to Arcata, Humboldt County. He reports having had a most delightful sea trip both going and returning.

Glad tidings have been received of the arrival of a baby boy in the home of Mr. A. J. Stephens, Manager of the Vallejo District. This happy event occurred on March 18th.

Unknown parties mailed the following clipping to Mr. John Hunt, our genial Purchasing Agent.

It is taken from a recent issue of the San Francisco "Examiner", advertising a new serial story, but seems so appropriate that we quote it in full:

"John Hunt is a clean-cut character, modern in every sense of the word, alive to present day opportunities, quick to take advantage of impending conditions. His career as unfolded in the serial story 'Commercial Adventures of John Hunt,' has a many-sided interest. Through it all runs a thread of human interest and romance—but why tell more? The story begins Monday."

We regret to announce the death of Mrs. Emilia E. McKillip, mother of Mr. C. W. McKillip, manager of the Sacramento District. Mrs. McKillip was 75 years old, and passed away in Sacramento on the night of March 29th. She was one of the oldest residents of Sacramento, having crossed the plains and arrived in California in the early forties.

At the recent Flower Show held at the Fairmont Hotel, Mr. J. C. Love, Chief Auditor, was awarded first prize for best collection of California poppies; also first prize for miscellaneous collection of flowers exhibited.

Kathryn Helen Vansano is the pleasing name which has been bestowed upon the baby girl that arrived in the home of Harry Vensano, February 28th.

Mr. J. G. Courtney, who underwent an operation for appendicitis March 29th, died peacefully at 12:15 p. m. April 3rd, 1911. His mind was clear to the end and he realized he could not live. A wife and two children survive him, a daughter five years old and a baby son six months old.

Mr. Courtney was a father in the full sense of the word, a good citizen and beloved by all who knew him. He was a member of the Petaluma Parlor, No. 27, N. S. G. W., Petaluma Lodge, B. P. O. Elks, and of the Petaluma Court, No. 63, Foresters of America.

He was employed about three years by the Santa Rosa Lighting Company, prior to our Company's ownership, and has been employed steadily by our Company ever since, the last eight years and seven months in the Petaluma District, where he soon became acquainted and popular among the whole community. The employees of the Petaluma District feel keenly and mourn the loss with his bereaved family in this, their time of sorrow.

To the Employees,
Pacific Gas and Electric Company,
San Francisco Gas and Electric Company.

I beg to introduce myself to your kind attention as mail boy in the main office, San Francisco. I am a contestant of record for one of the valuable prizes offered by the San Francisco Examiner, which contest closes July 4th, 1911.

In the San Francisco Daily and Sunday Examiners, a coupon is being run in each paper, such coupons counting for one vote if sent in within the prescribed time printed thereon.

Three months' subscription counts for	300 votes
Six " " " "	750 "
One year's " " "	1,500 "
Five " " " "	12,000 "

I beg to respectively request that if you are not already committed to save these coupons, or contemplate subscribing to the paper, that you forward coupons or notify me at Room 304, 445 Sutter Street.

Very respectfully yours,

JOHN CALLAGHAN,
Mail Boy.

QUESTION BOX

Ask questions. Any one of the several thousand men and women in the Pacific Gas and Electric Company who wishes information pertaining to any phase of the company's work or concerning matters of common interest to residents of any section reached by the company's lines is urged to use this department freely. Send your questions to the magazine. There will be no charge.

Question.—How is the constant of an integrating wattmeter determined? By this I mean when it is connected with current or potential transformers either one of the other. What figure do you multiply the reading by to get the correct reading, and how is this figure obtained? To illustrate what I mean: a 5-ampere 100-voltmeter is to be used to measure the kilowatts used on a circuit using 50 amperes; a current transformer of 80 to 5 amperes capacity is connected in this circuit. What is the constant?

Again: A 5-ampere 100-volt polyphase meter is used on a motor circuit of say 25 amperes at 440 volts. Both current and potential transformers are used on the potential for the meter is obtained by a tap from the line transformer at its middle point or other available point. What is the constant? Of course it is understood that a circuit transformer is used on each of two of the motor legs, it being a three-phase motor. The other leg goes straight to the motor. R. G. W.

Answer.—If we have a self-contained meter, either single phase or pholyphase, with a constant of one (1), and apply it through the medium of current transformers to a circuit carrying larger currents than the current rating of the meter, we have to multiply the reading with the ratio of the current transformer. If the meter is applied to a circuit carrying larger currents and higher potential than the meter is rated for, the readings have to be multiplied with the product of the current transformer ratio times the potential transformer ratio.

If the line transformers are tapped at proper points to reduce the potential, the ratio of reduced voltage to line voltage will be equivalent to the potential transformer ratio. OTTO A. KNOPP.

Question.—When and where was the first hydro-electric power plant of the Pacific Gas and Electric Company built?

Answer.—Rome Power House was commenced in 1895, and is located on the South Yuba River, in Nevada County. This plant was a forerunner of the system now operated and owned by the Pacific Gas and Electric Company.

Question.—What is the combined horse power of the hydro-electric plants of the Pacific Gas and Electric Company?

Answer.—93,551, as of March 1st, 1911.

Question.—How many street cars are operated by the Sacramento Electric Gas and Railway Company?

Answer.—Forty-three.

Question.—What quantity of water is usually kept in storage in the petty reservoirs, through which the hydro-electric power houses are supplied?

Answer.—It is hard to give exact figures in answer to this question. The main storage reservoir, however, above the Electra Power House, Lake Tabeaud, has a capacity of 50,425,000 cubic feet. The petty above the De Sabla Power House has a capacity of 38,000,000 cubic feet.

Question.—What is a complaint meter?

Answer.—A Maryland complaint meter is provided with a revolving drum in the gallery, actuated by clockwork. The drum carries a roll of paper ruled into sections, each section representing hours designated A. M. and P. M. Every five-foot revolution of the test dial hand is impressed upon the roll by means of an inking device. The complaint meter is set in series with the house meter and readings of each carefully taken when complaint meter is set and removed. A comparison of the usage during the period of observation establishes the accuracy or inaccuracy of the house meter, and the graphic record shows the amount of gas consumed at any hour of the day and night. G. N. S.

PACIFIC GAS AND ELECTRIC COMPANY

DIRECTORS

F. B. Anderson
Henry E. Bothin
John A. Britton
W. H. Crocker
E. J. De Sabla, Jr.
F. G. Drum
John S. Drum
D. H. Foote
A. F. Hockenbeamer
John Martin
Louis Monteagle
Cyrus Peirce
Leon Sloss
Joseph S. Tobin
George K. Weeks

OFFICERS

F. G. Drum........President
John A. Britton........Vice-Pres. and Gen. Mgr.
A. F. Hockenbeamer.....2d Vice-Pres., Treas. and Comp.
George C. Holberton..Engr. & Gen. Mgr. S. F. G & E. Co.
D. H. Foote........Secretary
Charles L. Barrett........Asst. Secretary
W. R. Eckart........Consulting Engineer
J. H. Wise........Consulting Engineer

HEADS OF DEPARTMENTS

J. C. Love........Auditor
W. H. Kline........General Agent
R. J. Cantrell........Property Agent
George C. Robb........Supt. of Supplies
J. H. Hunt........Purchasing Agent
E. B. Henley........Manager Land Dept.
J. P. Coghlan........Manager Claims Dept.
H. Bostwick........Secretary to President
S. V. Walton........Manager Commercial Dept.
F. E. Cronise........Manager New-Business Dept.
W. B. Bosley........Attorney
H. C. Vensano........Civil Engineer
E. C. Jones........Engr. Gas Dept.
H. P. Pitts........Industrial Engineer
F. F. Barbour........Assistant to President
S. J. Lisberger........Engr. Electric Distribution
Sherwood Grover........Asst. Engr. Gas Department
C. F. Adams........Engr. of Electric Construction
P. M. Downing........Engr. O. & M. Hyd.-Elec. Sect.
C. J. Wilson........Asst. Engr. Electric Distribution
F. H. Varney.........Engr. O. & M. Steam & Gas Eng. Sect.

DISTRICT MANAGERS

Alameda County........F. A. Leach, Jr.
Antioch........F. J. Southerland
Auburn........H. M. Cooper
Berkeley........F. A. Leach, Jr.
Chico........H. B. Heryford
Colusa........W. M. Henderson
Dixon........C. E. Sedgwick
Fresno........E. W. Florence
Grass Valley........John Werry
Martinez........Don C. Ray
Marysville........J. E. Poingdestre
Napa........O. E. Clark
Nevada City........John Werry
Newman........W. A. Widenmann
Oakland........F. A. Leach, Jr.
Petaluma........H. Weber
Redwood City........L. H. Newbert
Sacramento........C. W. McKillip
San Jose........J. D. Kuster
San Rafael........W. H. Foster
Santa Rosa........M. G. Hall
Vallejo........A. J. Stephens
Woodland........W. E. Osborn

MANAGERS OF WATER DISTRICTS

Colfax (Alta)........Jas. Martin
Nevada (Nevada City)........George Scarfe
Placer County (East Auburn)........H. M. Cooper
Standard (Electra)........W. E. Eskew
Stockton (Stockton)........J. W. Hall

SUPERINTENDENTS OF POWER DIVISIONS

Colgate........Joseph Mini
De Sabla........I. B. Adams
Electra........W. E. Eskew
Marysville........C. E. Young
Nevada City........George Scarfe
North Tower........C. D. Clark
Oakland........William Hughes
Sacramento........J. O. Tobey
San Jose........J. O. Hansen
South Tower........A. H. Burnett
Stockton........E. C. Monahan
Solano........J. W. Coons, Acting

SUPERINTENDENTS OF ELECTRIC DISTRIBUTION

Berkeley........J. H. Pape
Oakland (Underground)........R. C. Powell
Sacramento........C. R. Gill
San Jose........A. C. Ramsted
San Francisco........A. R. Thompson
Oakland and Alameda (Overhead)........A. C. Brandt

SUPERINTENDENTS OF GAS WORKS

Martin Station........John Mitchell
Oakland........A. C. Beck
Sacramento........Edward S. Jones
San Francisco........Dennis J. Lucey
San Jose........R. H. Hargreaves

SUPERINTENDENTS OF GAS DISTRIBUTION

Oakland........George Kirk
San Francisco........W. R. Morgan

THE PACIFIC GAS AND ELECTRIC COMPANY

SUPPLIES HEAT, LIGHT AND POWER TO

Place.	Population.
Agua Caliente	50
*Alameda	23,383
**Albany	800
‡Alta	200
Alto	30
Alvarado	200
Allegheny	200
Amador	200
Angels Camp	3,200
Antioch	3,000
‡Auburn	2,376
Baden	1,500
Barber	200
**Belmont	600
Belvedere	481
Benicia	3,360
Ben Lomond	800
**Berkeley	40,434
Bethany	200
Big Oak Flat	150
Biggs	750
Black Diamond	500
Bohemian Grove	25
Brentwood	200
Brighton	100
Broderick	500
‡Brown's Valley	50
**Burlingame	5,000
Byron	200
Campbell	1,000
Camp Meeker	200
Cement	1,500
Centerville	500
‡Centerville	20
**Chico	13,000
Chittenden	50
**Colusa	1,582
‡Colfax	400
Colma	500
Concord	1,500
Cordelia	150
Corte Madera	350
Cordova	25
Cornwall	300
Crockett	2,500
Crow's Landing	375
Davenport	1,000
Davis	750
Decoto	350
Dixon	1,000
Dobbins	50
Drytown	100
Duncan Mills	150
Durham	500
‡Dutch Flat	400
Eagle Nest	50
‡East Auburn	1,500
**Easton	500
**East San Jose	1,500
Eckley	20
Eldridge	1,000
‡Electra	50
Elmira	150
El Verano	100
Emerald	50
**Emeryville	2,000
Encinal	20
Fairfax	250
Fairfield	800
**Fair Oaks	250
Folsom	1,500
Forestville	100
*Fresno	24,892
Gilroy	2,000
Glen Ellen	500
Gold Run	100
Grafton	350
†Grass Valley	4,520
Gridley	1,800
Groveland	50
Guerneville	500
Hammonton	500
**Hayward	4,000
Hollister	3,000
Ignacio	50
Ione	900
Irvington	1,000
Jackson	2,035
Jackson Gate	50
Kennedy Flat	50
Kentfield	200
Knight's Landing	350
Larkspur	594
Lawrence	100
‡Lincoln	1,402
‡Live Oak	200
Livingston	200
Livermore	2,250
‡Loomis	150
Los Altos	200
Los Gatos	3,000
Manlove	50
Mare Island	500
Martell	25
Martinez	5,000
**Marysville	5,430
Mayfield	1,500
Mayhew	50
**Menlo Park	1,500
Meridian	300
Middle River	75
Mill's College	150
**Milbrae	300
Mills	350
Mill Valley	2,551
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Mountain View	2,500
**Napa	5,791
Napa Junction	250
†Nevada City	2,689
Newark	700
†Newcastle	600
New Chicago	25
Newman	1,000
Niles	800
Novato	250
**Oakland	225,000
**Oak Park	8,000
Occidental	400
Ophir	50
Oroville	2,500
Orwood	50
Oswald	25
Pacheco	200
**Palo Alto	6,000
Patterson	100
**Penon Blanco	25
†Penryn	250
Perkins	200
**Petaluma	5,880
Peyton	250
**Piedmont	2,000
Pike City	200
Pinole	1,500
Pleasanton	2,000
Port Costa	600
**Redwood City	3,500
**Richmond	6,802
Rio Vista	200
†Rocklin	1,026
Rodeo	100
‡Roseville	2,608
Ross	556
Routier	30
***Sacramento	52,000
San Andreas	200
San Anselmo	1,531
San Bruno	1,500
San Carlos	100
**San Francisco	416,912
**San Jose	40,000
San Juan	150
**San Leandro	4,000
San Lorenzo	100
**San Mateo	7,000
San Pablo	1,000
**San Quentin Prison	1,600
**San Rafael	5,934
Santa Clara	8,000
Santa Cruz	11,146
**Santa Rosa	7,817
Saratoga	200
Sargent	50
Sausalito	2,383
Sebastopol	1,233
Selby	100
Smartsville	300
Sonoma	1,200
So. San Francisco	2,500
Stanford University	2,000
Stege	100
†Stockton	23,253
Suisun	1,200
Sunnyvale	2,000
Sutter Creek	2,000
Telton	300
Terminus	50
Tiburon	100
Tormey	150
†Towle	200
Tracy	1,200
Vacaville	1,177
**Vallejo	11,340
Vallejo Junction	10
Vernalis	50
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,446
Wheatland	1,400
Winters	1,200
**Woodland	3,187
Yolo	350
**Yuba City	1,160

*—Gas	48,275
**—Gas and Electricity	838,844
‡—Electricity and Water	34,685
***—Gas, Elec. and Street Car Service	52,000
†—Electricity, Gas and Water	7,209
Unmarked—Electricity only	128,428
	1,109,441

Service Furnished.	Number of Towns.	Total Population.
Electricity	204	1,061,166
Gas	52	946,328
Water	19	41,894
Street Car	1	52,000

EMPLOYS 3,500 people
OPERATES 11 hydro-electric plants in the mountains
3 steam-driven electric plants in big cities
18 gas works

SERVES ⅔ of California's population
30 of California's 56 counties
An area of 37,950 square miles
⅗ the size of New York state
½ the size of all the New England states combined

Pacific Gas and Electric Magazine

Vol. II | Contents for May | No. 12

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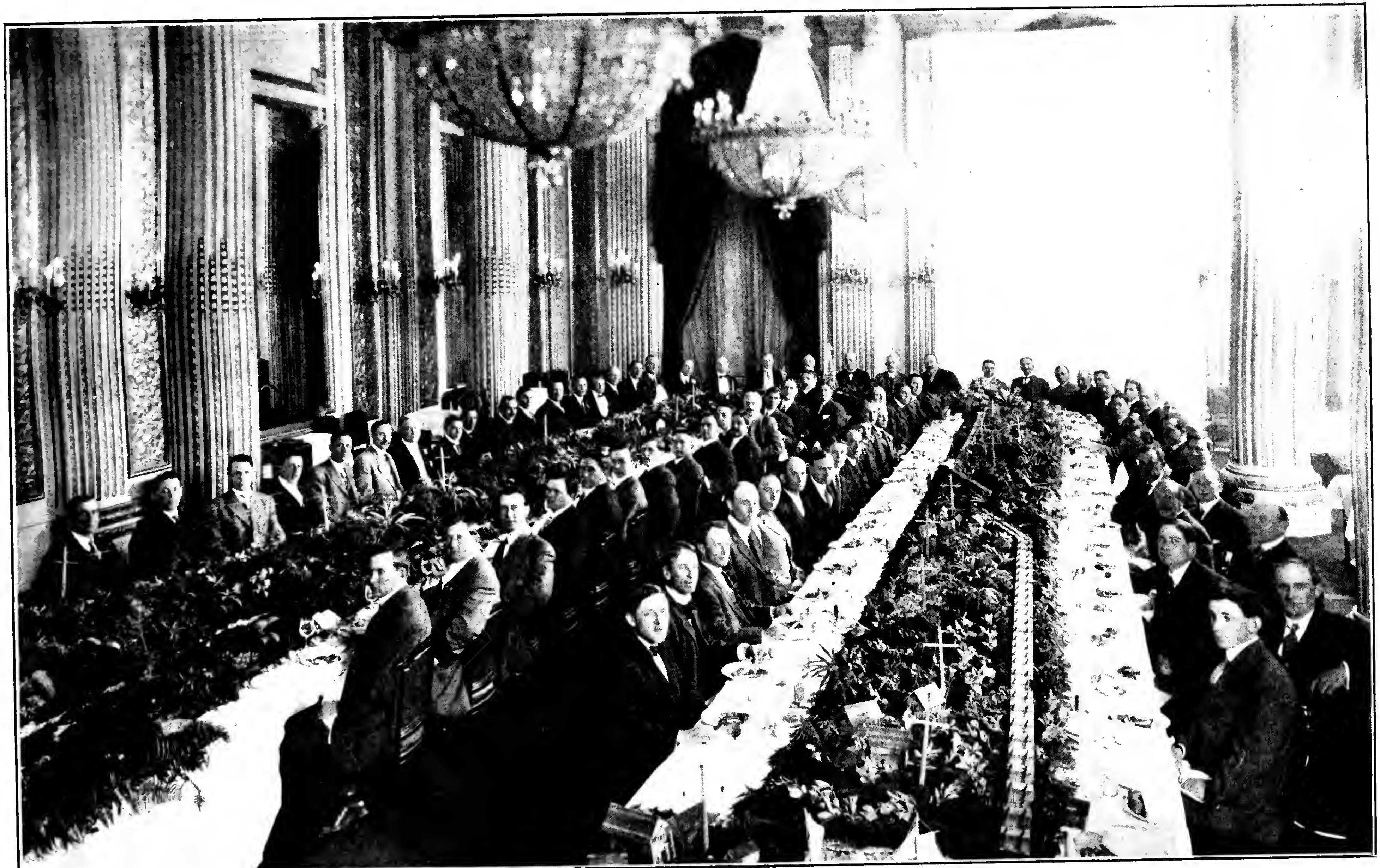


Officers, Directors, Heads of Departments, Managers and Superintendents of the Pacific Gas and Electric Company, at banquet in the St. Francis Hotel, Saturday evening, April 29th, 1911, held in conjunction with the regular monthly meeting of District Managers

Pacific Gas and Electric Magazine

VOL. II MAY, 1911 No. 12

The Voltage Regulator at North Tower

By GEO. H. BRAGG, Operation and Maintenance Department.

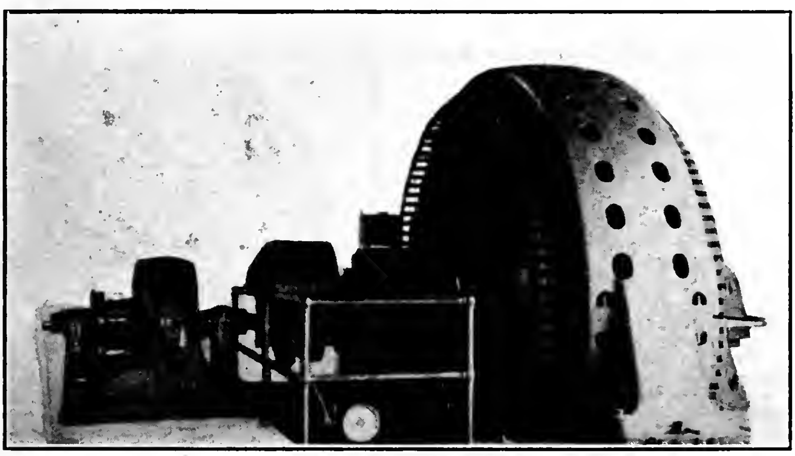
IN every system of electrical distribution there is a loss of energy and consequently a loss of voltage. The voltage delivered by the power house to the lines decreases in value as the distance becomes greater, depending in amount upon the size of conductors and load.

The commercial effect of this voltage loss is "poor light", or inoperative induction apparatus, and unless some means is employed to overcome it, the quality of the service is "poor."

Four types of voltage regulators or compensators are on the market today, each adapted to a particular kind of work. Without going into a description of them, they are as follows: The induction type, the step-by-step or dial switch type, the relay type, and the synchronous type.

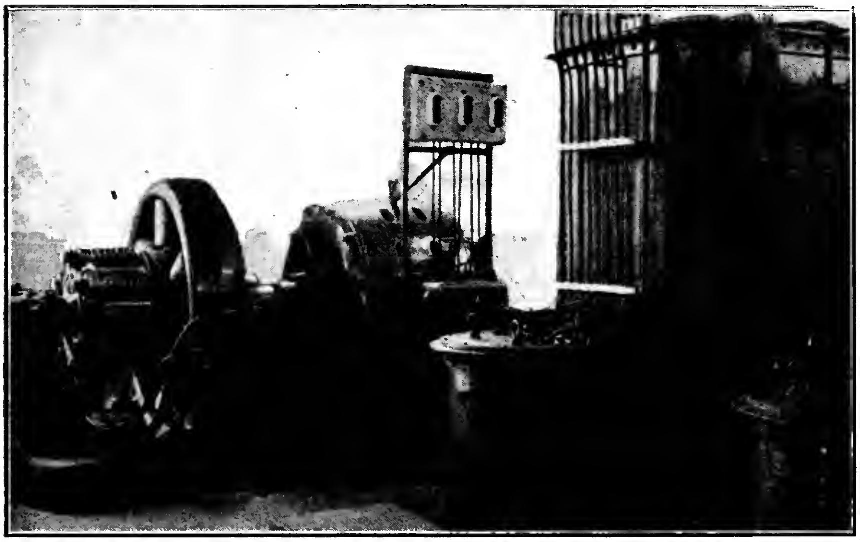
The first and second are used principally on the substation feeders, the third at the power house on the generators, although they are sometimes used in the substation on synchronous apparatus, and the fourth on long-distance transmission systems.

The regulator at North Tower is of the latter type. In every respect it is like the revolving-field generators at the power houses. Its nameplate reads as follows: "S. K. C. System. Revolving Field Alternator, Serial No. 1235—Type 144—4,400 K. W. Three-phase, 60-cycle, 11,000 volts, speed 300 R. P. M."



Snychronous Regulator

A brief description of the auxiliary apparatus comprising the complete installation will serve to explain the photographs and at the same time assist in a better understanding of the operation of the regulators. The 110-kilowatt motor-generator set serves the double purpose of exciting the regulator and furnishing power to its starting motor. It is driven by a 2,200-volt motor supplied by a bank of 35-kilowatt transformers, which steps down the station voltage from 11,000 to



Motor-Generator Exciter Set

2,200 for the motor. The 100-horsepower direct-current starting motor is geared to the shaft of the regulator, and it receives its power from the motor-generator set, as above stated.

In order to place the regulator in operation on the transmission system the 100-horsepower motor is furnished with power, and gradually the speed of the regulator is increased from rest up to three hundred revolutions per minute. At the proper instant the main switch is closed and the regulator then contiues to operate in synchronism at the constant speed of three hundred revolutions per minute, receiving the power to drive it from the lines. There is no further use of the starting motor; therefor, it is disconnected from the regulator and shut down.

It may be of interest to describe here the mechanical connection between the starting motor and the regulator. Bolted to the shaft of the regulator there is a large gear which meshes with a pinion on the shaft of the starting motor. This pinion is capable of being moved parallel with the axis of the starting motor shaft, the key and shaft being approximately double the width of the pinion. When the motor has performed its work, a lever is thrown over, and the pinion is moved on its shaft until it is out of mesh, then by opening the switch the starting motor will come to rest. The regulator is now capable of regulating

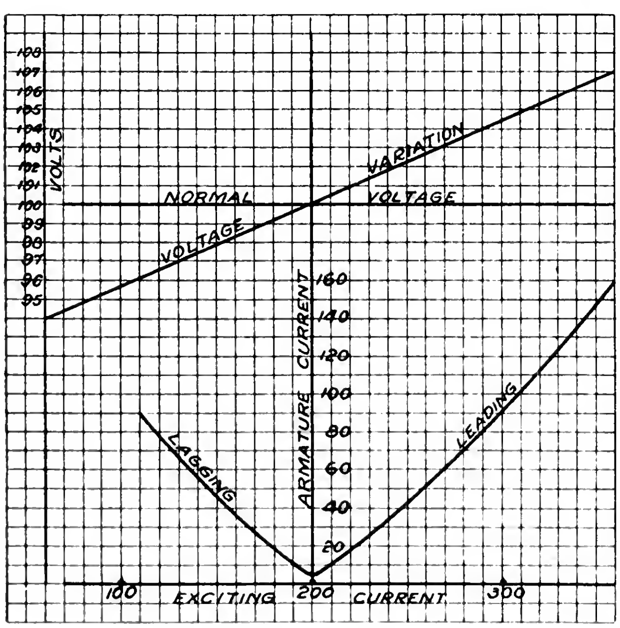


Fig. 1

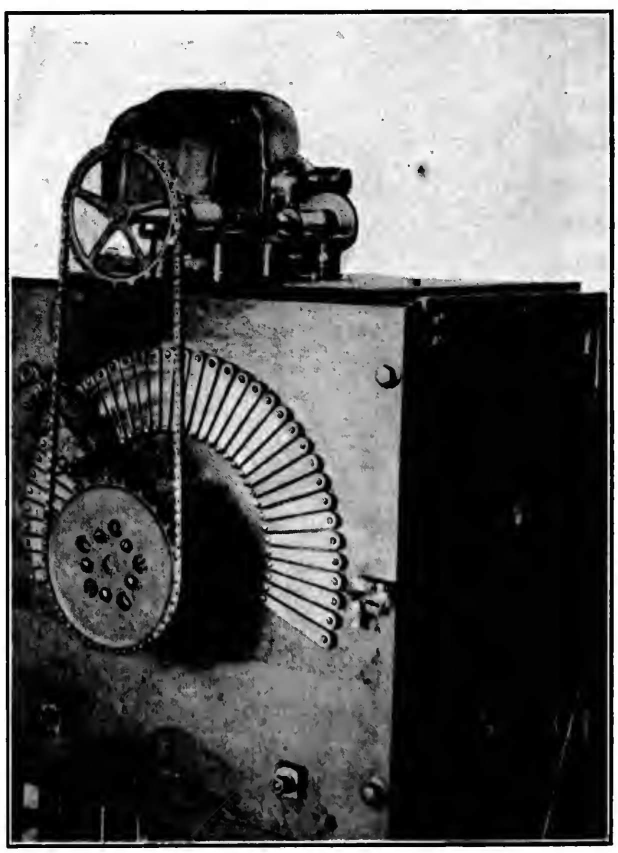


Fig. 2—Voltage Regulator

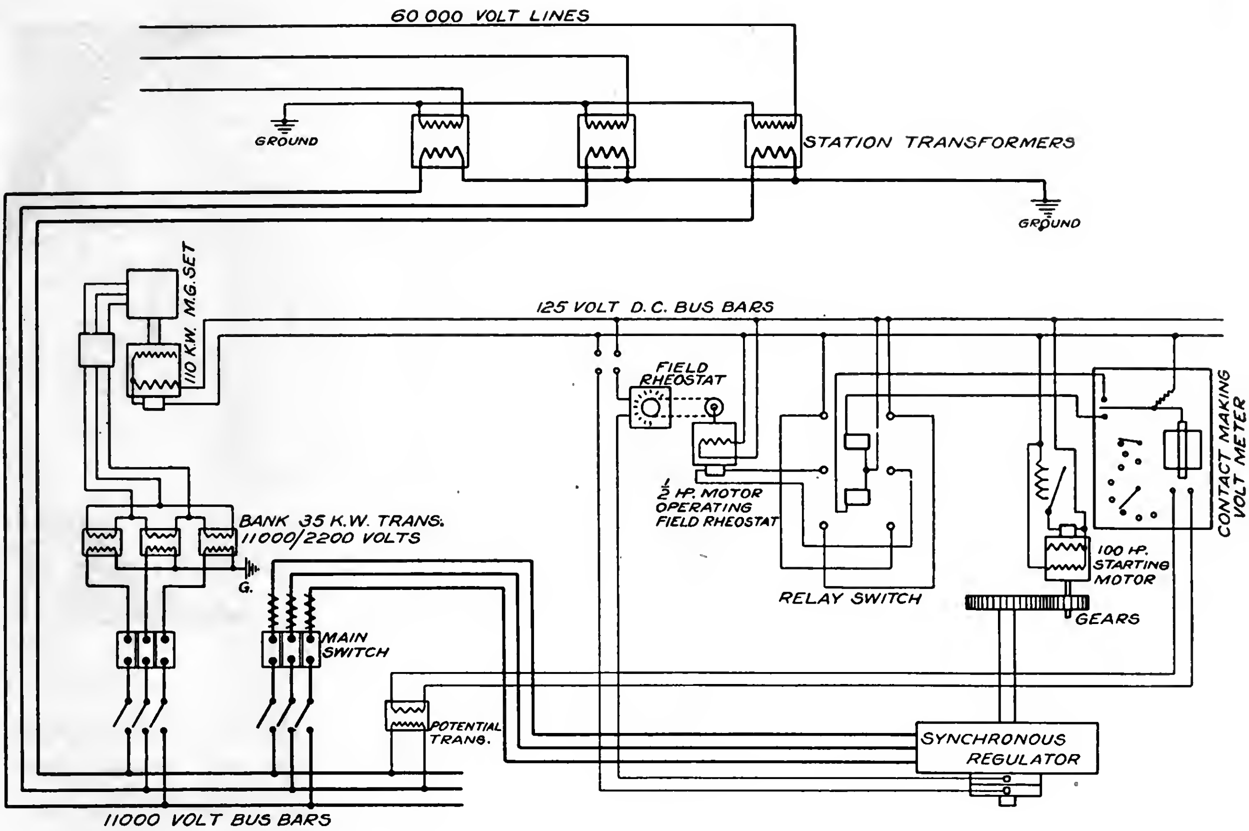


Fig. 3

the line voltage; by turning the hand wheel on the rheostat in its field, the current in its armature will vary. A point can be found where the current will be at a minimum, and a turn of the hand wheel in either direction will cause the current to increase. Graphically this is shown in Fig. 1.

Increasing the exciting current from the minimum armature current condition causes the regulator to draw a leading current, which in turn causes the voltage to raise. Likewise, decreasing the exciting current from the minimum armature, current condition causes the regulator to draw a lagging current, and this current causes the voltage to lower. The straight line at the top gives an idea of about the range of the regulator. It shows a regulation of approximately ten per cent, and for all variations within this range the line voltage can be held constant. To make the regulation automatic the rheostat of the regulator is equipped with a motor as shown in Fig. 2.

The motor is operated by a relay switch which in turn is operated by a contact making voltmeter. The wiring of this apparatus is shown in Fig. 3.

Main Transformers

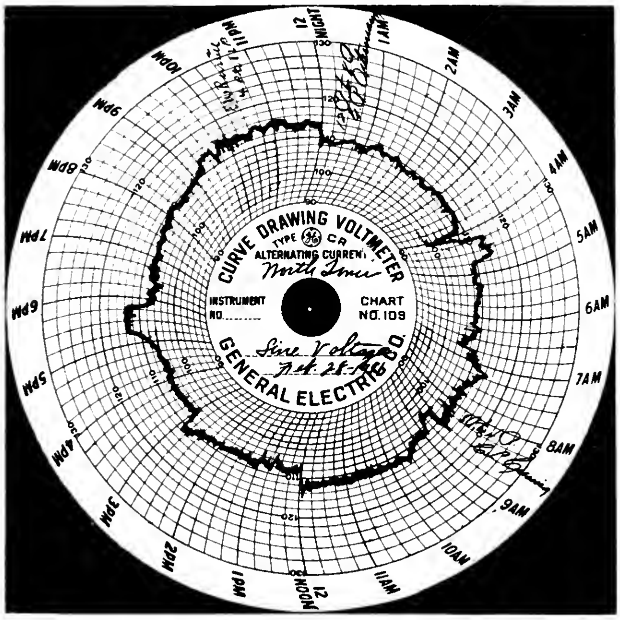


Fig. 4

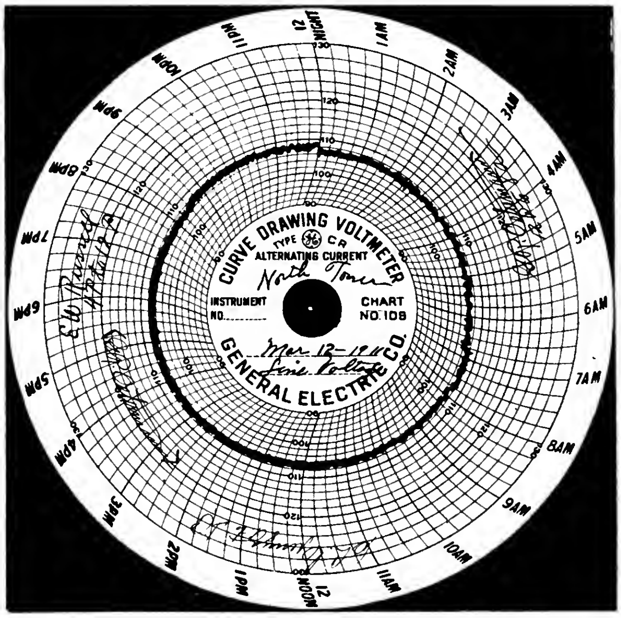


Fig. 5

A change in the line voltage from the predetermined value causes the contact making relay to move up or down. This movement operates the relay switch, which in turn operates the motor on the rheostat.

Figs. 4 and 5 show the voltmeter charts taken under similar conditions, Fig. 4 with the regulator off and Fig. 5 with the regulator on.

A voltage regulator of this type is a most economical investment, under certain conditions, as by its use the leading current which it is capable of drawing, counteracts the lagging current taken by consumers' apparatus.

A system may have so much load that another line or heavier conductors would be required. The installation of a synchronous regulator would not only obviate the necessity of the heavier line, but would maintain a constant line voltage when installed.

"DEE-LIGHTED"

When "Teddy" addresses a crowd from the stump
  And tells how our wrongs may be righted,
He makes his best bow, then smiling says,
  "My friends, I am truly dee-lighted."

The master when sitting in front of the gas grate,
  Where the good gas fire is lighted,
If asked what he thinks of his bright, cheery fire,
  Why he readily answers: "I am truly dee-lighted."

The housewife, whose troubles and cares we all know
  So often must go unrequited,
Likes a range free from soot, that's clean, hard and clear—
  With gas range and heater " she is dee-lighted."

And mama the cook who rejoices to know
  That her troth to her "Hubby" is plighted—
Ask her about gas for her heater or range
  And she'll answer, "Why! I am surely dee-lighted."

So we see that the master, the housewife or cook
  In praising the gas are united;
And so likewise you, when you use it will say,
  "*Gas is the best, I'm dee-lighted.*'

—D. J. Barr, Oakland.

Engineers—A Warning and a Suggestion

By H. C. VENSANO, Civil Engineer.

H. C. Vensano

It was my misfortune a short time since to have one of the higher officials of our Company make the remark to me 'That all engineers are dogmatic and not amenable to suggestions from others in or out of their profession.' These may not have been the exact words, but they were words to this effect.

I had made the remark that a certain party in another profession was rather self-centered and a hard man to do business with, as he did not care to receive any suggestions. It was then that the above-mentioned official remarked that not only the man in the profession under discussion but also *all* (please note) engineers were similarly constituted. As our official was a man who has had large experience in working with and employing engineers, I was much surprised, for one of the first principles taught me in school was that an engineer's duties were largely of a judicial character. If I remember rightly, there are several chapters on this subject in Raymond's Plane Surveying, one of the first books handed to Engineering freshmen.

It is, in fact, often the case that engineers' duties are entirely judicial. For instance, any inspector upon construction work is in such a position. It is his duty to decide not for the owner, but as between the owner and the contractor. After interpreting the specifications for the work, it is his duty to see that each is treated fairly, and that each receives his dues.

If an engineer is not open to suggestion, does not weigh every suggestion offered, and obtain all the good there may be therein, and if he does not store the information so received away for his own future use, he will always remain in the lower ranks of his profession.

What one learns for one's self from books or experience is only a very small part of what can be learned from the experience of others. I would warn all the budding young engineers of the Company, and those just starting to practice their profession, that fixedness to their own ideas and the non-observance of suggestions of others should be carefully guarded against. It marks a man who will never rise in the engineering ranks.

It is no sign of poor engineering to admit the value of advice of others or to change from an idea which you have advocated to a better one that has been suggested. It would be a remarkable man whose ideas are always the best and could never be improved upon. Personally, I have never met a man in my profession, be he very old in the work or very young, from whom I could not in association obtain some valuable ideas.

When it is found that two men educated along the same lines or in the same profession are continually unable to get together on ideas or are continually unwilling to accept suggestions from each other, one may be sure that at least one and possibly both such so-called engineers are not engineers at all, and the sooner their services are dispensed with or directed along other than engineering lines the better it will be for all concerned. They have not the judical temperament and are therefore not engineers.

An old definition of an engineer is, I believe, "a man who can do for one dollar what any fool can do for two."

Anybody can dig a ditch, but it takes an engineer to dig one economically. There is a chance for economy both in the design and construction of even such a simple thing as a ditch.

Unfortunately, employers of engineers do not always treat them on the same plane that they treat other professional men. A man

will hire a physician and will not think of hiring another on the same case, except for the purpose of consultation in extreme conditions. On the other hand, many corporations or others employing engineers do hire a number of such and so distribute work to them that their duties will overlap, and in many parts of the work we will have two men on the same job. The layman realizes in the case of the physician that the result of dissension between doctors would be disastrous to the patient. If the same thing does not hold true in the engineering case, it will be only because all the engineers concerned have the judicial temperament developed to the highest degree.

Under conditions where a number of engineers must correlate in their work, each must not only expect to weigh all suggestions from the others carefully, but then even when still convinced as to the correctness of his original ideas, must often give in to the others in order to become an engineer under the two-dollars' worth for one dollar definition. While one's own idea may be actually best, if one insists on having his way and thereby delays the work or requires refiguring or replanning, he is probably causing the expenditure of more dollars than the idea would ultimately be worth. To avoid dissension and discussion, a true engineer must be often willing to accept certain features of a plan which he does not approve, but which he knows will do, in order to expedite the work. The one ground upon which an engineer may stick to his idea is the dollar-and-cent basis. It is fortunately generally possible to closely estimate the cost of two divergent ideas. Such estimates should usually settle any dispute between men who are really up in their profession.

To repeat, all engineers may occasionally differ and differ obstinately, but if two men supposedly engineers persistently and obstinately differ, they are not true engineers and should not be employed as such.

I will offer one suggestion, however, which may sometimes explain the seeming non-susceptibility of professional men, whether engineers or others, to suggestion.

Before doing so it might first be well to relate a certain experience of my own which will carry its own moral. Shortly after graduating from college I spent a number of months as rodman in a surveying crew, and in this humble position I slept in the same tent with the axmen of the party who were, perhaps needless to say, in general, uneducated. There was one man in particular with whom I spent my evenings in discussion, and, as the saying is, "He often got my goat." We argued on various topics, and no matter what arguments I offered they were unavailing, as he was unable to appreciate their value. The incident which I desired to mention in particular occurred during a discussion on the value of certain additional fortifications for the San Francisco harbor. I was in favor, and he against. After considerable argument he finally said: "Well, after all, what is the use of any fortification of San Francisco Bay? No foreign battleship could ever pass the New York batteries and fortifications." I was not able to decide then, nor have I been since, whether he thought the foreign warship after passing the New York fortification intended to come overland to San Francisco, or whether he thought San Francisco was on an inland ocean the entrance to which was guarded by the fortifications of New York.

I stopped discussing then and there, and never had another argument with him. I saw it was entirely useless.

Along this line it is often the case than an engineer will receive a suggestion from a layman or a brother in a more or less nearly allied profession which while seemingly rational to the average hearer, is entirely untenable to the trained mind receiving it, for technical reasons. It is also often impossible to explain the irrationality of such suggestions

at all to the lay mind, or at least it is impossible to do so without spending a great deal of time in discussion and by practically educating the suggestor along perhaps very unaccustomed lines.

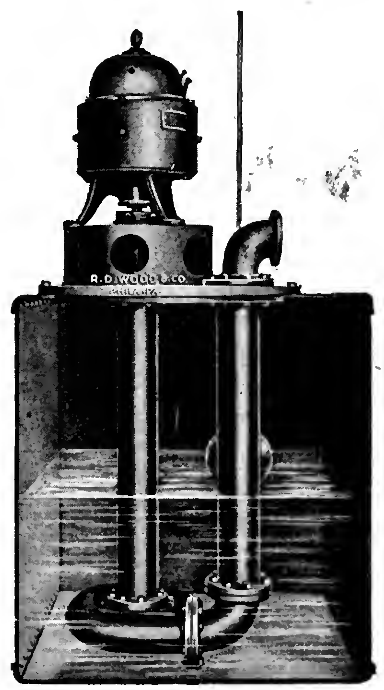
If an engineer has merely one man to satisfy he will often attempt to do this, but if there are a number of men offering suggestions it becomes impracticable to do so. The engineer then falls back upon merely disregarding such suggestions without attempting to give reasons therefor. It may then seem that he is dogmatic and unappreciative.

I now hasten to apologize for my illustration of the case of the axman. I do not intend to hint that my professional brothers in the mechanical, electrical or mining fraternity, or for that matter, the average layman is in the same class as the axman, or that their ideas along civil engineering lines are in a class with his in geography. Ill-advised suggestions are annoying and tiresome to one who is trying to complete a piece of work. They not only are generally unusable but produce additional bad results in that they tend often to lead others astray who have already been started along the correct line of thought.

I would therefore like to offer a further suggestion to all engineers who must work in cöordination, and in doing so I hope that I may not be misconstrued or deemed impertinent by my seniors in this Company, for in this organization, as in many similar, the condition outlined above, exists. That is, it is often necessary for a number of engineers in allied lines to cöoperate on a single project. In cöordinated work time will be saved for all concerned if suggestions are only offered when an engineer is sure that he is reasonably well acquainted with that of which he speaks or, if the question in point is outside his own line, he should speak only in cases where he must do so because it effects his own particular portion of undertaking. It is often the case that a considerable amount of time is lost by an engineer in explaining to someone else the inadvisability of the use of a certain idea which the latter has promulgated. For while it may be given in a perfectly justifiable desire to advance the interest of the work, it will often be inadaptable when offered by a party not technically educated along the particular line in which the work lies.

I would therefore suggest that when a man is employed to do a certain class of work, the work be left to him in so far as possible. If he then is the right engineer in his position he will ascertain if there are others in the same company whose suggestions would benefit him, and will of his own accord seek their advice.

Messrs. R. D. Wood & Co., headquarters Philadelphia, have forwarded to this office for publication in the Company magazine, an electro of a centrifugal pump, manu-



factured by them, and which we take pleasure in publishing.

It is claimed that these pumps embody in an unusual degree compactness, accessibility, and durability. The cut represents a five-inch vertical sewerage pump, capacity one million gallons per 24 hours, arranged in a sump for automatic operation.

An Echo From 1849

By E. E. DODGE, Engineering Department.

FAR up in Amador County near the head dam of the Upper Standard Canal, through which the water flows that turns the great Pelton wheels at the Company's largest plant at Electra, is to be found, if a person is at all given to wandering off the beaten tracks, a small miner's cabin with a fireplace built out in the open under the blue sky.

In this small cabin, overlooking the Company's source of energy, lives one of the oldest pioneers of the mountains; a man grizzled by over seventy winters, but still hale and hearty and working at his chosen vocation in the bosom of old Mother Earth in his quest for gold. His only companion, aside from the beasts that roam the mountains, is the young son of Mr. A. A. Swithenbank (ditch-tender for the Company in that district), a sturdy youngster of six, with snappy blue eyes, light hair, and a well-developed boy for his tender years. Wherever old "Len" Harden is to be found, there also is to be seen his "little pardner" close at hand, and always with an eye to business with his: "Pardner, do this," or "Pardner, do that." Generally old "Len" acquiesces in silence, but now and then he balks with a "Now, I'll be darned if I will, Pardner," at which the little fellow orders again and usually wins out.

The lad takes quite a pride in their ability—whether prospecting, hunting, fishing or trapping, and as fishermen the two hold the title as champions in the district, the little fellow's duties being the important task of taking the fish off the hook, which is performed quite skillfully, but now and again Len will hurry him on with a "Hell, pardner, are you going to take all day in getting that fish off."

It is very amusing to see this team coming down the road, the lad in the lead with his high-top mountain shoes, and his old Pardner bringing up in the rear, wearing an old black

hat, red shirt, and with his overalls strapped about his middle and hanging so low that you gasp in horror, fearing that every moment they will surely slip off of him completely.

The accompanying illustration shows the old man and his pardner with a night's catch, which included two wild cats, two coons, seven gray foxes and four pole cats; the little fellow intending to have a coat manufactured out of their trophies for his mother.

They find that trapping pays better than mining in the winter months, so they turn their energies in that direction during the winter. The little fellow's ambition is to become a lawyer and make plenty of money, that his pardner may have no further need to work.

Installation of Gas Heating Furnaces

The following letter from the Oakland District in response to a recent inquiry made by the Redwood District, is herein published, and called to the especial attention of all District Managers, as containing information which will be beneficial throughout our territory, in connection with installing gas heating furnaces:

We are pleased to acknowledge receipt of your letter of March 25th, asking for our experience with gas furnaces.

The gas furnace has been a perplexing problem since its inception some few years ago. The first winter's bills are high. After the first year the housekeeper becomes diligent and economical.

When asked the costs compared with coal by those considering the installation of a gas furnace, we endeavor to give a clear understanding as to the conditions. We feel that it is much better to have a customer satisfied with gas than to start in with it and then go over to something else. We tell the applicant that if necessary and proper attention is given to a gas furnace, it is economical; otherwise it is expensive.

The gas furnace must receive this attention for successful operation; which is no more than to regulate the heat, and turn out when not wanted.

A large percentage of furnaces are equipped with two or more concentric ring burners. These burners generally do not permit of a small flame; that is, their efficiency requires a large flow of gas for proper mixture of air through the Bunsen.

These conditions invariably call upon us to take out the burners and install pipe burners; that is, burners made of ordinary wrought iron pipe. These are straight lengths, varying from eighteen inches to two feet, according to the size of the furnace. A small furnace is equipped with a large and small burner; larger installations with a double set. The large burner is generally made of $1\frac{1}{4}$-inch pipe, drilled with $\frac{1}{4}$-inch holes, an inch apart, in two rows on each side of the pipe at what would be the upper side at 45 degrees. The small pipe burner is made of $\frac{3}{4}$-inch pipe drilled in the same manner with $\frac{1}{8}$-inch hole.

We compare the operating methods of a gas furnace with that of the gas range. For instance, should it be desired to boil a kettle of water, it should be placed over the large "Jumbo" burner. When the water comes to a boil, 212 degrees, it has reached its maximum; hence the large flame becomes a waste of energy. The kettle can then be transferred over to the small simmering burner, and this burner, with a very small flame, will maintain the kettle of water at 212 degrees as long as desired. Likewise with the gas furnace. The large burners should be lighted

for quick results. As soon as the temperature of the house has been brought to the desired degree of warmth, the large burner should be turned out and the heat maintained by the small burners. When no further artificial heat is desired, or necessary, the burners should then be extinguished. This is the attention which the gas furnace requires.

Gas bills, for heating residences, range from $15 to $30 per winter month. The cost is necessarily dependent upon the area to be heated, the temperature required, and the frugality of the consumer.

As to the costs compared with coal, we state that it may be true that during one or two months in the winter gas may possibly be a little more expensive than coal. However, we find from careful inquiry that upon taking the total bills for the year, gas will average less than coal. The reasons are that a large quantity of coal is required to build up a coal furnace fire, the fire has to be built some time in advance of when wanted, and a coal furnace cannot be extinguished at pleasure. There are many days when heat is wanted but half an hour or so.

Gas furnaces are so constructed that air from out of doors is brought in through heating tubes, and then passed into the house without coming in contact with the gas or its combustion; hence sanitary conditions in such a system are superior to any circulating water system of the coal furnace. In the circulating water system by means of radiators, the impure air of the room is simply reheated.

Our difficulties with the gas furnace are mainly due to those who have inefficient help, or are lax about household management.

In one particular case of high-bill complaint, we were told that the furnace was only lighted for an hour in the morning and for a very short time in the evening. When our representative called, which was about eleven o'clock in the morning, the furnace was going at full head, having been started at seven o'clock. The sun was shining and the general atmospheric conditions warm, so that there was no apology for a furnace having been burning for several hours. In another case, a consumer told us that he was perfectly satisfied with a $20 bill, but to be charged $35 was out of all reason. He said that he had found the trouble—our gas was poor and did not give sufficient heat and was full of water. To prove his assertions, he had a puddle of water in the bottom of his furnace, which he could show us, that beyond a question of a doubt came out of the gas, as there was no other way for the water to get there.

Upon investigation, we found that there was a very small outlet to the flue of the furnace, with the result that the products of combustion did not properly escape, and in consequence were condensed into their natural element, water. The fact of so much water being in the bottom of the furnace was proof positive of a large consumption of gas as registered by the meter. The meter proved correct. We also called his attention to the fact that the month during which this large bill accrued was the coldest month we had had in twenty-four years. It also occurred at this time that the City authorities brought in an outside expert to test our gas and electric conditions. This expert pronounced our gas of high candle-power, and of high heating units. Nevertheless, with all this array of evidence, the consumer would not be satisfied and stated his determination that before next winter he would instal a coal furnace.

The writer met him some six months afterwards. He extended his hand, with the remark, "I want to apologize about my gas furnace. I want to say that I started out among my friends who are using coal furnaces, and after collecting the amount of their bills, and hearing the experiences, I am perfectly satisfied with the gas."

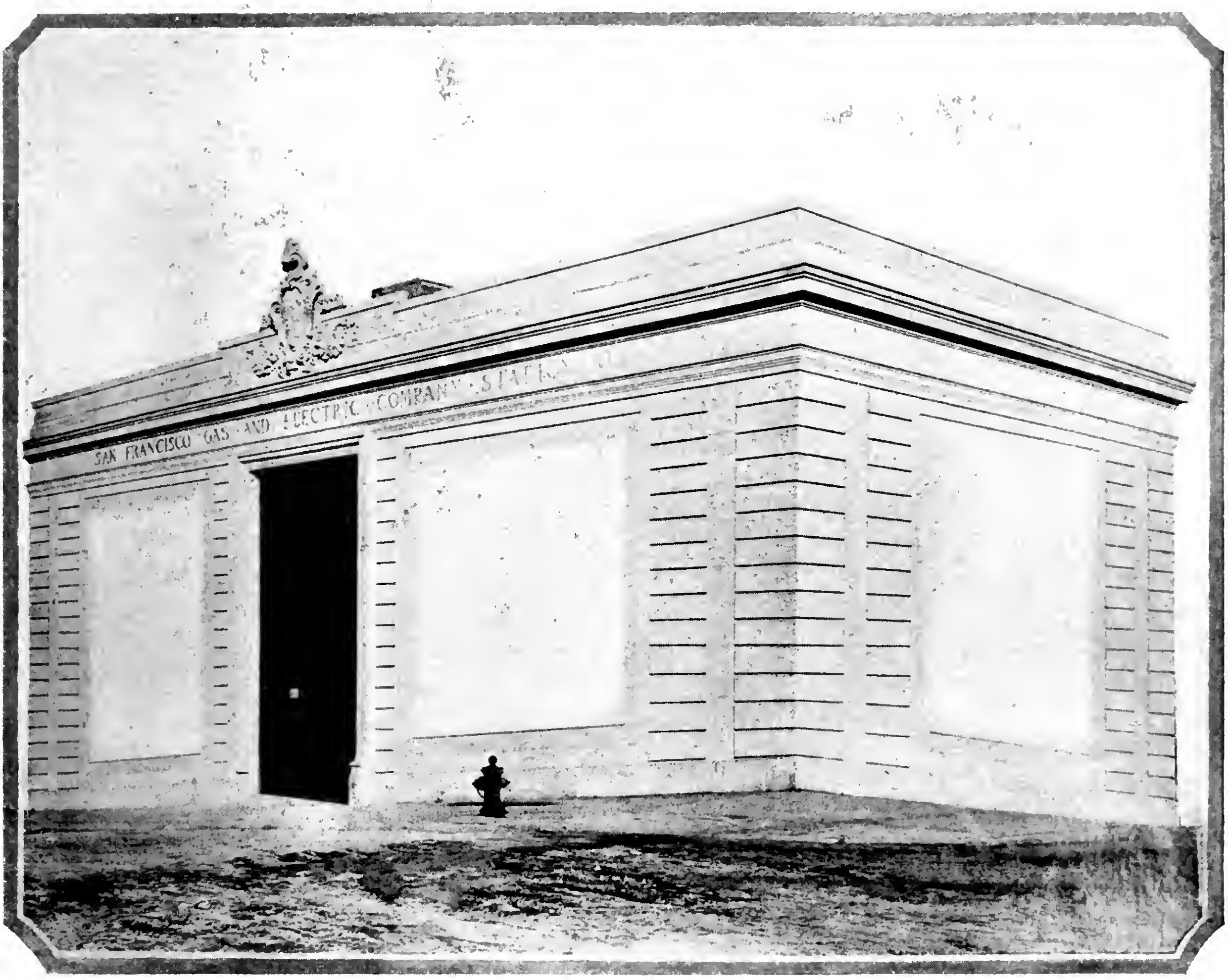
We have also converted a number of coal furnaces over to gas with satisfactory results. However, coal furnaces so converted have a lower efficiency than where built for gas. Some furnaces are not practicable for conversion, and where there is any question we advise against the change.

"Give me the man who can hold on when others let go; who pushes ahead when others turn back; who stiffens up when others weaken; who advances when others retreat; who knows no such word as 'can't' or 'give up'; and I will show you a man who will win in the end, no matter who opposes him, no matter what obstacdes confront him."

—*Orison Swett Marden.*

Station "G," San Francisco

By C. F. ADAMS, Engineer of Electric Construction.

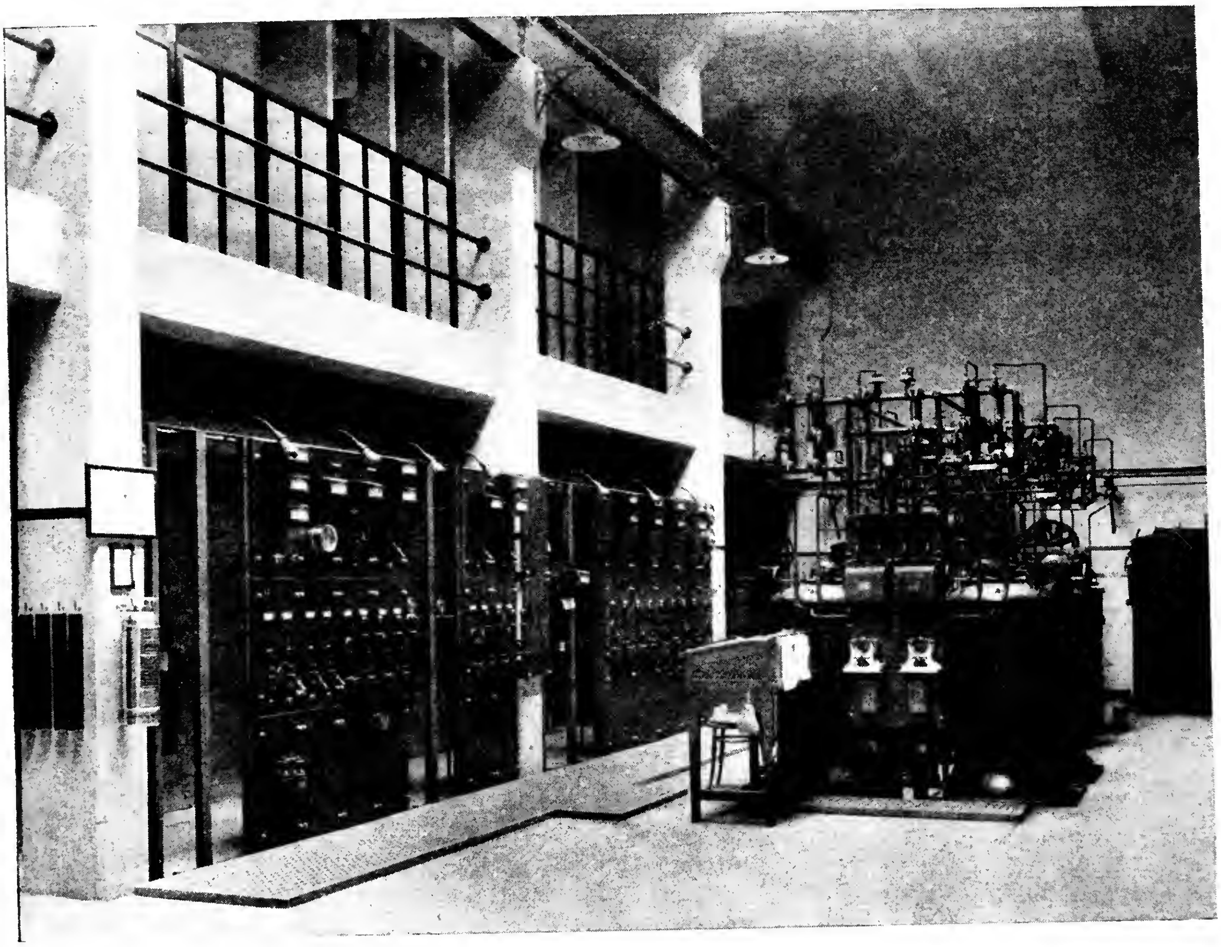


C. F. Adams

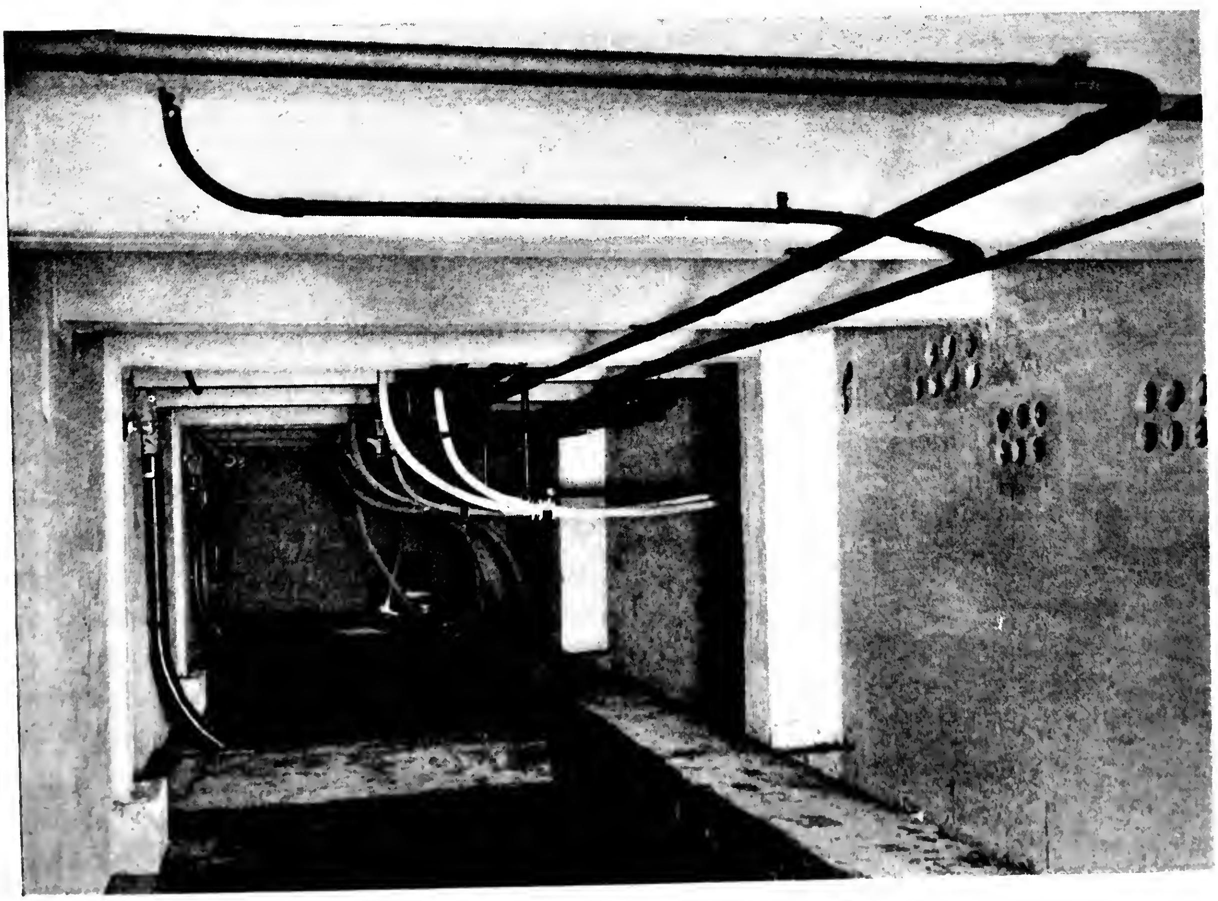
Out in the district north of Golden Gate Park a temporary substation was built four years ago. San Francisco emerging from many ashes and some sack-cloth would have amusement and the Chutes Park wanted light and power. A residence district also was building which required service.

Four years ago a prophecy as to the city's future was by no means unanimous, and temporary construction was sometimes advisable. With this in mind a steel frame and galvanized steel structure was erected, large enough to supply present local conditions. In the four years that have elapsed, changes were many. Van Ness Avenue has ceased to be a business street, the down-town district having been rebuilt and reoccupied. The congestion in and about Fillmore Street has been relieved, and the entire center of population has shifted. Also the load center of the gas and electric service has shifted.

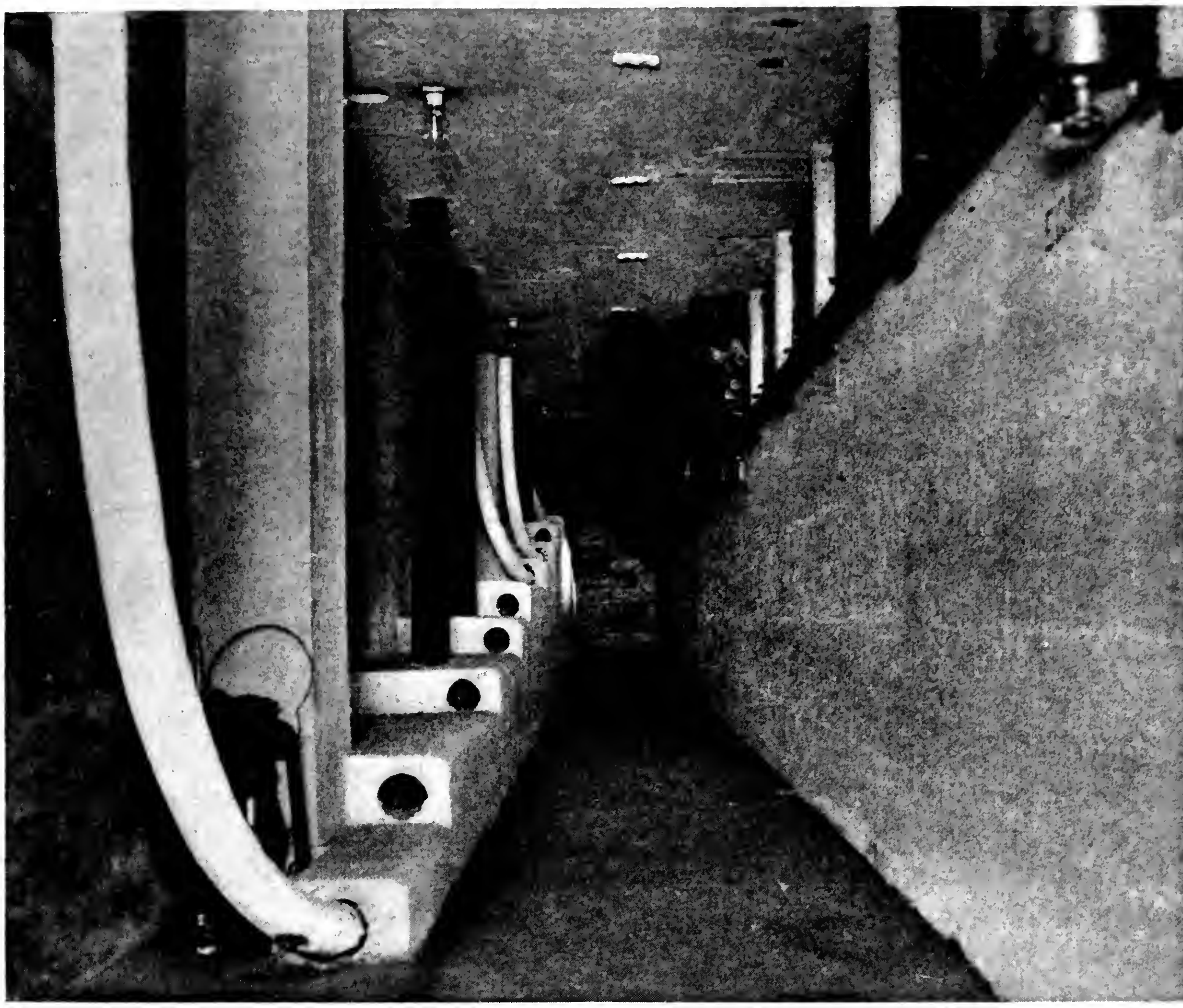
To follow this shifting population the Chutes Park has moved to Fillmore Street, and its old leased location has been sold to home builders. Thus it came that the Chutes substation was obselete and required a new



Main floor—showing switchboard and voltage regulators



Subway beneath switchboard



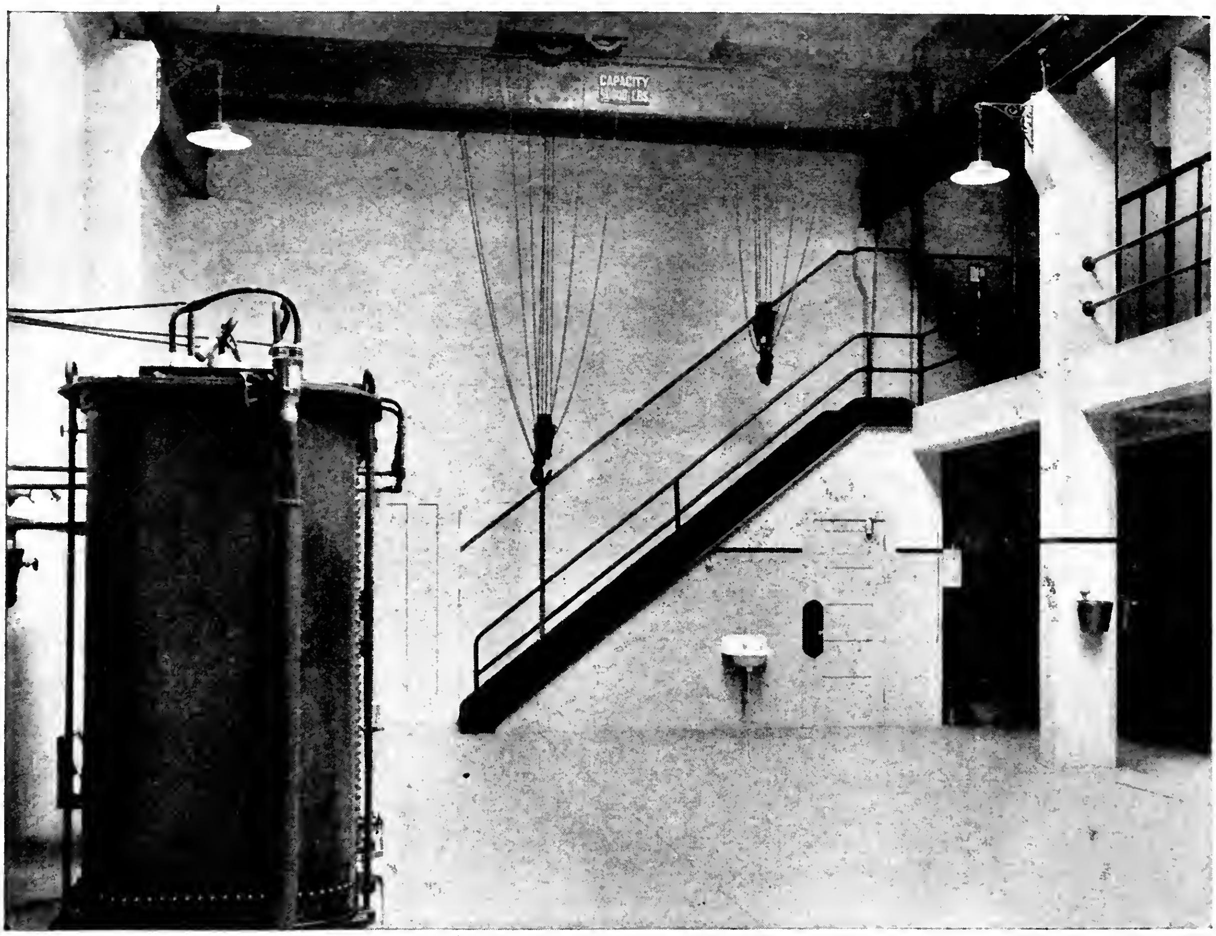
Passageway back of switch-cells, showing cable outlets and switch operators

and more effective location. A careful survey was made of the territory west of Fillmore Street, and a location was finally secured on the northeast corner of Ellis and Broderick Streets. This was in a residential section and plans were drawn for a station that would not be out of harmony with its surroundings.

The station is unique in some respects. It does not contain a single window in its four concrete walls, light and ventilation being obtained from a long overhead skylight and louvre. A large panelled oak door is the central feature of the front wall. The architectural design is pleasing and is well pictured in the illustrations.

The building is constructed of reinforced concrete throughout. Within the building every convenience is provided for the safe control of the equipment. A gallery supports the concrete switch cells which contain the 11,000-volt bus, oil switches, and current transformers. A twenty-ton travelling crane spans the main floor and permits quick removal of any heavy apparatus. The switchboard is on the main floor along the line of gallery columns. The 2,300-volt two-phase switching equipment and bus is beneath the gallery floor and directly back of switchboard. A roomy subway gives access to all the operating mechanisms, cable and conduit outlets. Three thousand kilowatts capacity of transformers is at present installed with voltage regulators for four circuits.

For street-lighting purposes, five arc transformers are in service. The station provides



North end of station, showing gallery stairway

floor space for two sets of 1,000-kilowatt motor-generator sets, whenever the growth of the nearby Fillmore district demands such service. A small storage battery with a charging set supplies direct current for operation of switch mechanisms and signal lamps. Transformer water is cooled by a tank and cooling tower on the building roof.

The entire station and equipment are of a permanent character, and reflect the policy of the Company as regards high-class work and the best possible service.

Telephone Deposit Required

To the Editor of the *Bee:*

Sir:—Kindly inform me through your columns whether the telephone company is within its rights in demanding a deposit of $5 before furnishing service to a new subscriber.

ENQUIRER.

Sacramento, January 6th.

The question of a telephone company's right to demand a deposit of $5 as security for the payment of bills was decided in the affirmative by the Railroad Commission of Wisconsin last year, citing numerous court decisions to the same effect.

The reasons given are that a telephone company, or other public-service corporation has a right to protect itself in this way against losses which otherwise would tend to increase the general cost of service and to raise rates to everybody.

In a New York case it was held that a rural telephone company had a right to require payment of telephone rent for six months in advance.—*Sacramento Bee.*

The Man You Can't Defeat

By HERBERT KAUFMAN, in the *Denver Post.*

He is n't afraid of failure, and so after awhile failure becomes afraid of him. But, when all 's said and done, failure is like every other bully and turns tail at the first hint of a whole-hearted, fearless defense.

What if he does stumble—granted that he does go down in defeat time and time again—just watch him fumbling, crawling, husbanding his strength bit by bit, gripping fast with his last shred of grit and his last flash of wit—never despairing—watching and waiting until he sees the chance and then Zip! before you realize it, he is on his feet again and up against the wall ready to take on any comer.

He keeps learning what not to do until he has narrowed down the field of mistakes and errors, and by the sheer process of elimination he knows at last the few sane, safe principles of success.

The size of a task never appalls him—his courage is great enough to lift him shoulder to shoulder with any enterprise to which he aspires; his resolution is the most terrific ram that ever battered the walls of circumstance.

Errors of judgment and his over-zeal repeatedly hurl him to earth. But while he lies on his back he does n't waste time wailing because of his failing; he does n't rehash the past and moan and groan over what is done and what can 't be helped; he takes count of his assets and figures out how he can return to the game.

He does n't mind the broken bones—they 'll knit; or the bruises—they 'll heal; or the sprains—time will take care of all of them. So long as his spirit is n't fractured and his determination is n't splintered, he 's not shattered but only battered.

The mere loss of goods is just a loss of time; if he has n't lost his manhood and his memory, he can duplicate whatever he possessed and re-attain whatever he dropped.

You can "break" him but you can't break his back-bone. You can bind his activities, but you can't tie down his spirit. You can handicap him, he 'll win out against you as surely as day must follow night.

He puts his own judgment in the scales and the prejudices of the whole universe won't outweigh it; while there is breath in his body, and hope in his breast, and nerve in his meat, he is ready and eager to pit his ambitions against all humanity.

Do n't waste the time to laugh at him, to shrug at him or strike at him; the joke is bound to be on you in the end. He's padded all over with self-assurance, a sneer can't get through his vitals. Disbelief and incredulity rattle against his sheath of confidence like dry peas upon a stone wall.

Whenever you try to hold him back you simply turn him into a bow—you bend him into greater power, and when you let go you have loaned him the strength to hurl his shaft of determination twice as far.

He 's a human spring—the greater pressure you put upon him, the further he 'll rebound.

Opposition is his whetstone; it simply puts a deeper edge upon his keenness.

Every unfair dig that he receives is a spur-tear.

It does n't stop him, but sends him leaping ahead. It arouses his latent, lurking amperes and kilowatts of force—it calls upon his reserve of energy and sets it surging and singing through his being, doubling his horsepower, intensifying his voltage until he breaks every band and bond of opposition.

Do n't measure him by his years; courage never rusts with time.

He 'll break new ground for himself up to the hour that you break ground for him.

You can't tell how he 'll finish, until he finishes.

The reproduction above is from a photograph sent by District Manager Osborn, and gives an idea of what the town of Woodland has had to contend with this spring.

The water was higher than ever known before, and on March 7th, when this photograph was taken, the town was entirely cut off from railroad communication by wash-outs on both sides. The cross on the right shows one of our poles leaning badly, but the current was too swift to permit of repairs for several days. In spite of the unusual conditions existing during this storm period, continuous service was maintained.

Redwood City Industries

Redwood City is already feeling the good effects of the opening of the new Dunbarton transcontinental route. The Southern Pacific Company has built a spur track from the "cutoff" line almost to the Redwood City water front for the Stauffer Chemical Co. The plan of improvements which the railroad has in view is the making of wharves all along the Redwood slough.

The salt-making industry of Redwood City has become extensive. The Grecco Salt Co. has 450 acres two miles northeast of the city. They have $100,000 invested, and employ fifty men during salt-making season. The crude product is shipped by boat to San Francisco for refining.

The Stauffer Chemical Co. owns 1,500 acres along the slough extending to the city. It makes 150,000 to 200,000 tons a year, and employs two hundred men at certain seasons.

The Horstman Chemical Works manufactures soda ash, refined sal soda and baking soda. Its plant covers an entire block and has good spur track facilities.

Tanning is another well-established industry here. The Beeger Tanning Co.'s factory covers two blocks and employs seventy-five to one hundred men. The Frank Tanning Co., on the slough, employs two hundred men, and its plant covers five acres.

The Gas Meter

By SIGMUND SCHWARTZ, Foreman, Meter Repair Shop, S. F. G. & E. Co.


S. Schwartz

The only existing medium between company and consumer whereby the amount of gas consumed can be determined, was invented and patented by W. Richards in England in 1844, and later launched upon the commercial world by Thos. Glover. This is the dry gas meter, the wet gas meter having become obsolete.

It consists of a box, usually rectangular in shape and made of tin plate, divided into two main compartments by a horizontal partition. The lower of these compartments is also divided into two equal parts by a vertical partition midway between the front and the back of the meter. In the upper compartment there is an enclosed gas-tight chamber.

The measuring apparatus contained in the two divisions of the lower compartment, consists of a bellows in each division, formed by means of a circular metal disc fastened to one edge of a leather diaphragm, the other edge of which is attached to the central partition, the whole forming a gas-tight space. The alternate opening and closing of these bellows, by the pressure of the gas as it is admitted first into the space inside, and then into the spaces outside of them, furnishes motive power which, by suitable mechanism, is made to operate valves to control the flow of gas into and out of the diaphragms and outer spaces, and also to work the gears which record the amount of gas passed through the meter. The mechanism also controls the extent to which the bellows can open and close, so that a fixed and definite amount of gas passes into and out of the meter each time they are filled and emptied.

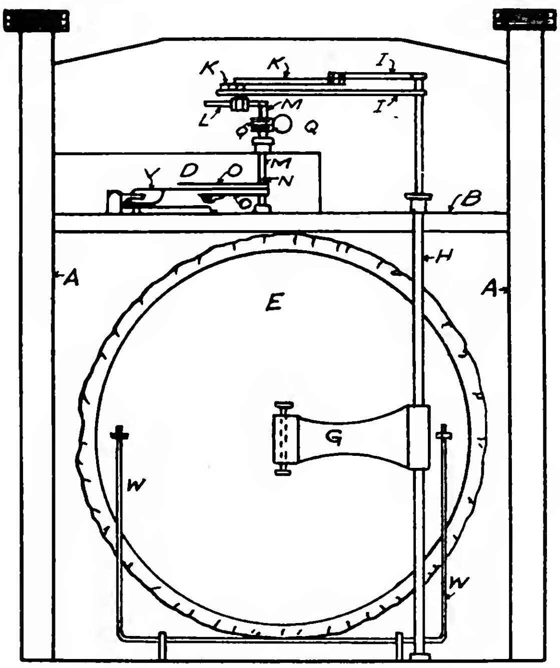
Referring to the accompanying views, AA is the case; B the horizontal partition; C the vertical partition; D the valve chamber; EE the metal discs, and FF the diaphragms; which are so attached to the discs and partitions that they can only bend outwards. Each of the discs is guided so that it moves along straight lines by the wires W W, and to each is loosely attached one end of an arm G, the end of which is rigidly fastened to a vertical rod H, resting in a bearing on the bottom of the meter and passing through a stuffing box into the upper compartment. The upper end of each of these vertical rods is rigidly fastened to one end of a pair of arms I and K, joined together loosely by a pin. The other end of each of the arms X, is fastened to a pin on a crank arm L, working an upright shaft M. This shaft passes through a stuffing box into the valve chamber and is there provided with an eccentric N, from which the valves VV are worked through connecting rods OO.

The valves are D-valves working on seats containing ports exactly like those in a steam engine. In each case the admission port nearest the shaft opens into the space inside the bellows, while the exhaust port opens into a channel leading to the outlet pipe. A channel from the inlet pipe brings the gas into the valve chamber, which is always filled with gas coming from the service.

The valves are set at such an angle with one another, that the supply of gas cannot be cut off from both sides of the meter at the same time, and consequently there is no danger of its sticking on a dead center.

Starting with the valves in the position shown in the cut, the action is as follows, it being assumed that the gas is used: The inside of the bellows in the front compartment, and the space outside the bellows in the back compartment are opened to the inlet, while the outside space in front, and the inside of the bellows in the back, are opened to the outlet through the valves and the exhaust port. As gas is being used the pressure on

the outlet side is reduced, and the higher pressure in the spaces open to the inlet causes the front bellows to open and the back bellows to close. In moving the discs EE,

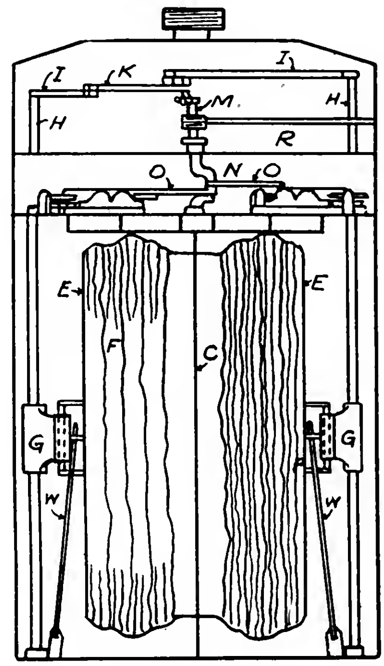


VIEW WITH BACK REMOVED

carry with them the arms GG, and a turning motion is thus imparted to the rods HH, from which it is transmitted through the arms LL and KK, to the crank L, and to the shaft M and the eccentric N. The rods HH oscillate back and forth through a small arc only, but by means of the arms II and KK and the crank L, this oscillatory motion is transformed into a rotary motion of the shaft M.

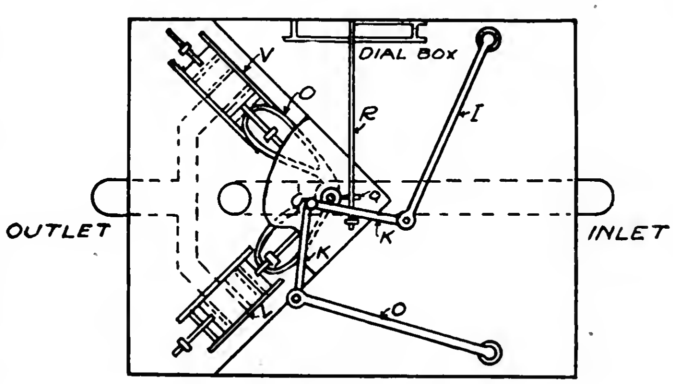
The turning of the eccentric moves the valves until the conditions of the port opening are reversed, first by the front valve, and shortly after by the back valve, and the gas then flows into the outside space in front, and into the bellows in the back, the front bellows closing and delivering gas, while the opening of the back bellows forces gas out of the outer space. A trip catch is provided, which trips and allows the crank L to pass over it when the crank is turning in the right direction, but catches and prevents its turning in the wrong direction, and thus prevents the meter from running backward.

It is evident that for each opening and closing of each bellows an amount of gas is displaced which is equal to the volume of the space traversed by the disc, that is, the volume



VIEW WITH SIDE REMOVED

of a cylinder having a base equal to the area of the disc, and a height equal to the length of its travel. As the length of travel is kept constant by the controlling mechanism described above, every revolution of the shaft



VIEW WITH TOP REMOVED

M corresponds to the passage of a fixed, definite amount of gas, and to record the amount of gas passed, it is only necessary to record the number of revolutions of this shaft on a dial arranged to read, not this number, but the number of feet of gas corresponding to it. To do this a worm wheel P is placed on the shaft M. This worm wheel works a

gear wheel Q, on a horizontal shaft R, running to the dial of the meter and carrying on its outer end the test hand on this dial. The number of teeth in this gear is so taken that one revolution of it, and the shaft will represent either two, five or ten feet, according to the size of the meter.

In a five-light meter, the size of the discs and the length of their travel may be so adjusted that one sixth of a cubic foot of gas is displaced during a complete cycle of operations corresponding to one complete revolution of the shaft M. One revolution of the test hand on a meter of this size corresponds to two feet, so the gear wheel P is given twelve teeth, and the shaft Q therefore makes one revolution for each twelve revolutions of the shaft M. This shaft Q is the driving shaft of the recording mechanism, and the required rate of revolution of the other hands on the dial, is obtained by using the proper chain of gear wheels.

Following, the writer will endeavor to convey the assembling of a meter, showing the magnitude of the work.

In constructing a meter, the valve seats, long channel, forked channel, and forked channel outlet are soldered to the table top. The partition is then soldered to the long channel and the forked channel outlet, forming the letter T with the table top. The clam shells and pocket channels (generally one piece) are then soldered to long channel, forked channel, table top and partition. The bottom is then soldered to the bottom of the partition forming the letter I, with the partition of the table top. The sides are next placed in position and soldered, the one to the bottom partition, table top and long channel, and the other side to the bottom, partition, table top and forked channel. The front and back gallery plates are then soldered to the sides and the table top. This divides the meter into three compartments—the gallery or space above the table top, and the two diaphragm chambers beneath the table top; one on each side of the partition. The inlet and outlet column to which the meter swivels have been soldered, are then soldered to the sides of the meter. The crank step is then soldered into position on the table top, and the ram soldered to the front and back gallery plates and the table top.

The meter at this stage of its construction is called a skeleton meter. The wide rings of the diaphragms are then notched to make room for the pocket channels, and the diaphragms soldered to the partition and pocket channels; one on each side of the partition. In the large meter, a wire is placed inside of the diaphragm to prevent the leather from collapsing; the two ends being held against the partitition by two pieces of tin soldered to the partition, which forms hinges and allows the wire to swing back and forth with the movement of the diaphragm. The discs are next soldered to the narrow ring of the diaphragm, the flag rod steps soldered to the bottom of the meter, the flag rods placed in position, and the flag rod stuffing boxes soldered to the table top. The flags are then soldered to the flag rods and the disc carriages to the discs. The disc guide wires are now placed in position and the boots soldered to the bottom of the meter and the disc guides to the disc. The flag rod stuffing boxes are then stuffed, and the flag arm placed in position; the long flag arm being soldered to the flag rods. Before these arms are soldered in position, the crank stuffing box is soldered to the three-cornered piece and the cover arms are attached to the crank, the crank placed in position, and the three-cornered plate soldered to the top of the arm. The flag arms are then adjusted—that is, placed in such a position that the crank will be midway between the two extreme positions of the diaphragms—as indicated by the flag arms. The flag arms are then soldered to the flag rods. The front case is then soldered to the bottom, sides and front gallery plate, and the back case to the bottom, sides and back gallery plate.

The crank axle wheel is then soldered to the crank. The wires that guide the valve covers, and hold the valve wrists are then soldered to the valve covers and the valve guides soldered to the table top. The position of the valve wrists are then determined from the length of the cover arms, and the valve wrists soldered to the wire which guides the valve covers. The bridge is then soldered to the three-cornered piece, and the tangent tacked to the crank in as nearly a correct position as possible. The valve seats and covers are then ground, the cover arms attached to the valve covers, and the back plate soldered to the side, front gallery plate, back gallery plate, three-cornered plate and top of the ram. The index box is then soldered to the front gallery plate, index soldered to the table top, horizontal axle and wheel placed in position, and the horizontal axle rest and click soldered to the three-cornered piece. The short flag arms are then attached to the tangent wrist, and the meter is ready to be tested and proven. The top of the meter is soldered to the sides, front and back gallery plates after the meter is proven.

From the manner in which a meter is constructed, it will be noticed that it is divided into six essential compartments: The valve chamber, two diaphragms (the space enclosed by diaphragms), and two diaphragm chambers (the space enclosed by sides, case, bottom, table top, and diaphragm). The valve chamber has a direct connection to service by way of the inlet column, hole inside of meter, long channel and hole in table top. The diaphragms have direct connection with the valve chamber through the diaphragm port, clam shell and pocket channel. The diaphragm chambers have direct connection to valve chambers through diaphragm chamber ports. The forked channel outlet has direct connection to the outlet of meter or consumer through side of meter and outlet column. The diaphragms have direct connection to forked channel outlet, through the pocket channel, clam shell, diaphragm port, valve cover, outlet port, and forked channel; and the diaphragm chambers have direct connection to the forked channel outlet through diaphragm chamber ports, valve covers, outlet ports, and forked channels. By shifting the valve covers, we have four complete passageways through the meter from the service to the consumer. Two, by way of inlet column, side of meter, long channel, hole and table top, valve chamber, diaphragm port, clam shell, pocket channel, diaphragm, valve cover, outlet port, forked channel, forked channel outlet, side of meter and outlet column. The gas makes in all ten 90° bends, two 45° bends, and reverses its direction in valve chamber and diaphragm. The other two passageways are through inlet column, side of meter, long channel, hole in table top, valve chamber, diaphragm chamber port, diaphragm chamber, valve cover, outlet port, forked channel, forked channel outlet and outlet column. Gas makes in all, six 90° bends, one 45° bend, and reverses its direction in valve chamber and in diaphragm chamber.

We will now discuss the relative position of the valves and the diaphragms. The valves are set at a position 90° apart and as they are both controlled by the same crank, the one valve will always be 90° ahead of the other. Due to the fact that the crank revolves, and the valves travel back and forth in a straight line, this is not true; but for the purpose of discussion we will assume it is true, as the difference is very slight.

The diaphragms are connected to the crank by the flag arms, which are arranged in such a manner that the one diaphragm is 90° ahead of the other, or the one diaphragm is at the end of its stroke, when the other diaphragm is at the center of its stroke and *vice versa*. The tangent is attached to the crank at an angle, which places the valve 90° ahead of the diaphragm which it controls, or the diaphragm is at the end of its

stroke, when the valve is at the center of its stroke, and *vice versa*.

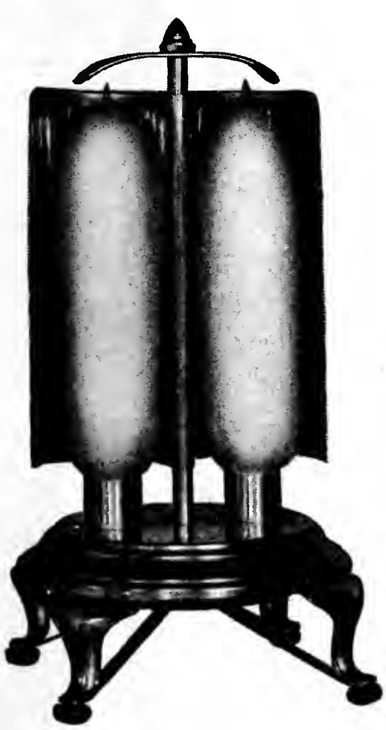
The method of procedure with respect to repairs to consumer's meters, is as follows: The meter enters the shop and stands for twelve hours, this to enable the meter to become acclimated, for testing purposes—since it is essential that the meter be of the same temperature as the atmosphere in the room in which it is to be tested. It is then put on the proving apparatus and tested. To show the delicacy of this test, it might be well to mention, that the water in the prover must be identically the same temperature as the surrounding atmosphere, since the difference of 4° between the water in the prover and the atmosphere, will show a discrepancy of 1% in the test.

The top and back of the meter is then removed and the diaphragms tested; after which the meter is drained, stuffing boxes repacked, valves ground, back plate replaced, and back to the proving apparatus. The top is now soldered on, meter repainted and ready for the consumer.

Meter records are at the present time being contemplated, being in the form of a history card bearing the date of the meter; when received by the company; the maker's name; maker's number; the company's number; the size and statement—this being filed in a cabinet and ready for immediate reference.

Twin-Glower Electric Radiator

The twin-glower electric radiator, developed by the General Electric Company, has ready applicability; has been given first consideration in that the heating elements are de-



signed for a maximum energy consumption of five hundred watts, and permits the operation of radiator on any lighting circuit. Ready applicability has been obtained without sacrificing the various well-known advantages of the luminous type of radiators. The same "non-oxygen consuming" radiant heat, essential to hygienic conditions in sick rooms and hospital wards, for safe-guarding the health of households, is available, and extreme lightness permits of radiator being easily removed.

When the regular heating system has a low tone, it can be used for increasing the temperature of any room in the home. Absence of carbonic acid renders its use particularly desirable in rooms containing paintings and beautifully bound books, which otherwise rapidly deteriorate.

Facts relative to the economy of these devices are of vital importance to prospective users, as they always like to know the price of a device and the cost of operation. The price of the electric radiator is about a third more than the six-pound electric flat-iron, and cost of operation is about five cents an hour at the usual charge for current.

Only a single trial is required for permanently establishing the electric flat-iron, radiant toaster and disk stove, as necessities, and to add the twin-glower electric radiator to the popular trio.

Fire Prevention

IT is nearly thirty years since the annual property losses from fire in the United States were less than $100,000,000, and the average for the last ten years is considerably over $200,000,000. In thirty-three years the total loss has amounted to the stupendous sum of $5,000,000,000. Insurance statisticians long ago demonstrated that the destruction of property by fire in the United States is inordinate in comparison with losses in other countries. There is no question that American cities as quite as well equipped to fight fire as European, but there is every evidence that we are much less careful in preventing it. Berlin, which has a larger population than Chicago, suffers an annual fire loss of about $150,000, while Chicago's amounts to about $5,000,000.

The appalling loss of life in the shirtwaist factory in New York has impressed the lesson that criminal carelessness is all too common. Investigation has shown that similarly shameful conditions prevailed in hundreds of other establishments. Nothing but the most stringent laws and their most drastic and vigilant enforcement will prevent men taking chances that hourly endanger life and property. Even after such a ghastly lesson as that of the shirtwaist factory, there will always be some men who will lapse into carelessness just as soon as vigilance is relaxed.

One notable result of the New York disaster is found in the resignation of Fire Chief Croker. Apparently he did not resign because of any criticism of his record or ability, for it is generally acknowledged that Croker was the most efficient and successful fire-fighter there has ever been in the metropolis. But Croker seems to have believed that he could be of more service to the community and to humanity in the business of preventing fire than in fighting it. His experience has taught him that a large percentage of fires are manifestly preventable, and he has become the head of a company organized to prevent fires. The company will supply experienced firemen wherever their services are in demand, at theatres, factories, office-buildings, warehouses, or stores. The dangers that might be overlooked by a building inspector will not escape the eye of the veteran fireman, and it is reasonable to suppose that he will be as inquisitive concerning neighboring buildings as he is vigilant over the premises it is his duty to guard. It should not be long before the owners of property protected by Croker's men may expect substantial reductions in their insurance premiums.

Another movement organized in New York is that of the "Fire Prevention Bureau," with the noted lawyer, Henry L. Stimson, who was the Republican candidate for governor, at its head. The bureau will undertake the prosecution of those who violate the prevention laws.

The science of fire prevention is yet in its infancy. What the new organizations in New York are able to accomplish will undoubtedly provide invaluable lessons to the rest of the country.

—*Evening Post*, May 2, 1911.

Magic Words—They Bring Big Returns

"Good Morning," "Good Night," "Hello There," "Good Bye," "Good Luck," "Thank You,"—magic words these—full of power possibilities. Do you use them, Mr. Business Man, in all the meaning of their creation? Clearly, heartily, enthusiastically; firmly, courteously, smilingly? In going after business, in closing up business. There are so many occasions where they can be applied; so many occasions where they have made customers out of prospects, friends out of strangers. It costs but a smile (which is always worth carrying), an open, honest, sincere manner of expression which no man can afford to be without.—*Dodge Idea.*

Authorized Additions and Improvements

SAN FRANCISCO. A four-cylinder, five-passenger automobile has been purchased for the use of the President's and General Manager's Office.

Contract has been let for one 1,000-kilowatt generator for the Mutual Station.

A gasolene runabout has been purchased for use of General Foreman of Gas Mains Department.

STOCKTON POWER DIVISION. Dwelling has been erected at Middle River substation for use of patrolmen and operators.

NEVADA WATER DISTRICT. Work has been commenced on the clearing out of Lake Spaulding.

COLFAX WATER DISTRICT. Three hundred acres of virgin timber land near Lake Valley has been purchased.

OAKLAND. Work has been commenced on underground and overhead tie-lines between Station "A" and Station "H", also the changing of sixty kilovolts on First Street to eleven kilovolts.

ELECTRA POWER. Reconstruction of the Jackson trunk seventeen-kilovolt line from Electra Power House to Sutter Creek substation has been commenced.

SOLANO DISTRICT. 6600-volt line from Putah Creek has been extended to a point near Tremont.

MARIN DISTRICT. Work has been started on installation of street lighting system at Kentfield.

NEVADA WATER DISTRICT. Construction of new outlet tunnel for Lake Fordyce reservoir, together with reinforcing work, has been commenced.

SOLANO POWER DIVISION. Construction of four miles ten-kilovolt line has been commenced to connect the several pumping plants of the Alameda Sugar Company.

REDWOOD DISTRICT. Work has been commenced in the laying of gas mains in the town of South San Francisco.

MARYSVILLE POWER DIVISION. Erection of a 165-foot steel line tower on the north side of the Sacramento River at Vernon, Sutter County, has been started.

DE SABLA POWER DIVISION. Work has been commenced on a 42-foot concrete arch head dam on Butte Creek, to replace present log crib structure.

OAKLAND DISTRICT. Three hundred and ninety-eight gas lamp posts have been ordered installed in the Linda Vista District north of Lake Merritt, and 26 gas lamp posts in East Fourteenth Street from First to Thirteenth Avenue.

PETALUMA DISTRICT. Extension of three-phase line to Cotton Brothers' Quarry has been commenced.

COLUSA. New Colusa sub connected April 26th with 60,000-volt line. O. and M. Department rebuilding line from Gridley to Biggs; new stretch of line from Gridley sub into Gridley at 2,300 volts instead of present 15,000-volt line.

MARYSVILLE POWER. New iron tank 60,000-kilovolt switches to be placed in Marysville substation to replace the old-style switches.

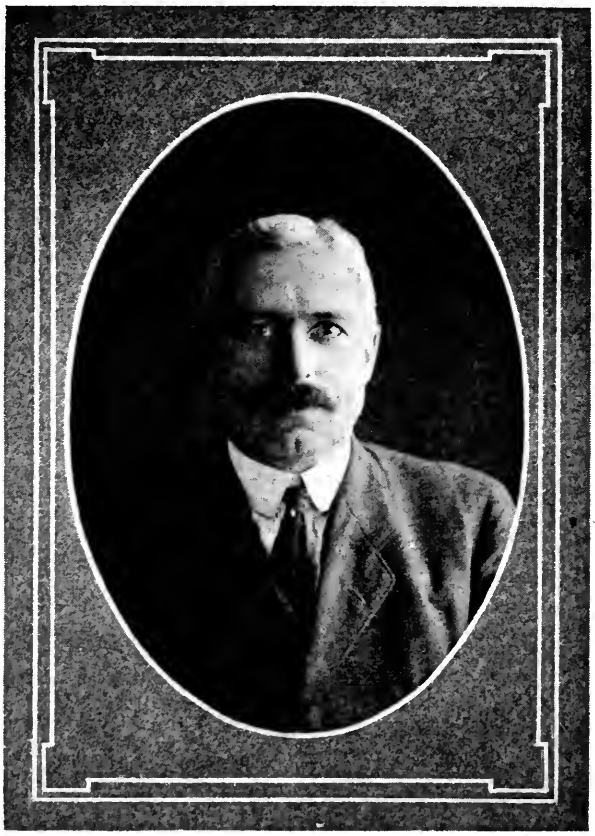
SOUTH TOWER DIVISION. Antioch substation being reconstructed and new switchboards installed. Large automatic regulator installed.

NORTH TOWER DIVISION. Automatic regulator installed and in operation at Napa substation.

MEN OF THE COMPANY

GEORGE C. ROBB

THE virtue of persistency is well illustrated in the career of George C. Robb, who occupies the position of Superintendent of Supplies of the Pacific Gas and Electric Company. He was born July 10, 1868, in Waterford, New York, and received the ordinary education required of pupils at the primary and grammar schools.



Of natural strong physique, and despising idleness in all of its phases, he set himself, at a very early age, to work out his own salvation, and not despising inferior types of employment, became a Rockman for the City of New York.

While his history does not so relate, it is very evident that his earnestness of purpose and determination to succeed attracted the attention of his superiors, for he soon became, in succession, Axeman, Rodman, Leveller. and Transitman in the employ of the City of New York on its reservoirs and water distribution.

Such work means many weary miles of travel over generally unbroken country, and sparsely settled places, but it brings a man closer to nature and makes him a judge of men and things, and, in the very exacting science of surveying, has a tendency to render a man not only in his private social life, but in his contact with other men, on the level and square. These qualities, while inherent in George C. Robb, were more strongly developed by reason of his occupation.

He later took up with the Stanley G. I. Electric Manufacturing Company, at Pittsfield, Massachusetts, work in their machine shop and transformer room, where he attracted the attention of Mr. F. V. T. Lee, former Assistant General Manager of this Company, and when a man with courage, resourcefulness, loyalty, and honesty was wanted by this Company, the characteristics of Robb were remembered and he was sent for.

In the chaos of material and supplies of a large organization, there was work found for busy hands and minds to do, and, in cooperation with Managers, Superintendents, and Heads of Departments, order has been brought out of chaos, and the Supply Department of the Company is run upon strictly economic lines.

The man who carries more stock than he ought to, hears in no uncertain terms, from the Superintendent of Supplies.

To him a surplus of material on hand is a waste of golden dollars, and to excite his praise the minimum quantity must be reached.

In his conduct of the Supply Department at Sacramento, he has instituted reform measures that have brought the manufacture of several parts of switches, and the rewinding of transformers to the lowest possible ebb; this is because he knows how and when.

A brass foundry and a foundry for iron castings are among his creations.

Some one has said that the Lord hates a coward; conversely, He must love a fighter, and "G. C. R." is something on the type of the fighter; not of the sort that always carries a chip on his shoulder, but the sort that fights for principle and fights because he knows he is right in fighting.

Like all other men he has frailties, but what's the use of telling of the things that we all know we each possess in the way of weaknesses, and it is better to tell of what the other fellow possesses in the way of strength that we do not always possess ourselves.

These writings of the Men of the Company may perhaps seem fulsome at times, but we are all of us going to be a long time dead, and it is better to say a word of kindness when you may, than to wear a suit of black some distant day as an expression of respect to one who has gone, and to sprinkle flowers upon his casket, why not spread a few of the flowers before a man while on earth, in order that he may get some of the perfume of kindness.

Gas Fuel For Steam Boilers

Few people realize the wonderful advance gas is making in the field of industrial use.

The Kane boiler, which has recently widened its sale to the Pacific Coast, is responsible for several very fine plants which are proving their adequacy and economy, using gas as fuel. The secret of the success of gas fuel steam boilers is to see that they are constructed for gas only. The Kane Boiler, both for power and for steam radiation in buildings, shows an actual efficiency of eighty per cent, absorbing this percentage of heat units in gas, into water and converted into steam.

With a plant in Taits Café it has been possible to secure one horse-power for every sixty-four feet of gas burned. The factory manufacturing this line guarantees one horse-power for every eighty feet of gas, but owing to the higher heat units in the gas in San Francisco, it has been possible to obtain better results. The following installations show the wide variety of uses to which this popular boiler may be put:

The Emanuel School on Sutter Street, near Van Ness Avenue, where the building is heated by automatic low-pressure boiler.

The residence of Byron Mauzy in the Jordan Tract, heated by low-pressure automatic boiler.

Eggers & Company, soda manufacturers, for bottle-washing machine.

Coffin-Redington Company, a four-horse-power high-pressure automatic boiler for making distilled water.

Tait-Zinkand Café, high-pressure boiler for supplying steam for heating the building, sewer pumps, and all apparatus in the kitchen.

These few installations show that much better results can be obtained from automatic steam boilers than is possible to secure by other means. It dispenses with the services of an engineer and thereby creates a great saving in the cost of operation.

Pacific Gas and Electric Magazine

PUBLISHED IN THE INTEREST OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - - - EDITOR
A. F. HOCKENBEAMER - - - BUSINESS MANAGER

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PACIFIC GAS AND ELECTRIC MAGAZINE
445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. II MAY, 1911 No. 12

EDITORIAL

AT THE DINNER GIVEN ON SATURDAY evening, April 29th, to the Board of Directors, Heads of Departments, and Men of the Company, Dr. Thomas Addison, District Manager of the General Electric Company, had occasion to say a few words, in response to a toast, that might well form the text for an Editorial.

Not quoting his exact words, but giving the sentiment, his theme was, that as was the man at the head of any institution, so were the men subordinate to him to be found.

If grouchy, ill-tempered, disobliging and fretful, his men would take the cue from that, and reflect him in all of their contacts with consumers of the Company.

If bright, cheerful, obliging and concilatory, the same echo would be found in the attitude of the men subordinate.

The question may well be asked then, of each of the District Managers and Division Superintendents, and of the heads of Departments, How do the men under each of you disport themselves?

It is believed that the reflex of yourselves as shown in your men is that of the type of the pleasant, affable, concilating kind, and if you have men in your employ who do not reflect that spirit, which the Editor believes is possessed by everyone in the Company, then if he does not mend his way, he should be replaced by one who can reflect the qualities that will make the Company which you represent popular.

It is, therefore, essential that in the organization which you represent, that the elements, to the lowest-paid man on your pay-roll, should be of the type that would reflect your own wishes and desires, and make the Pacific Gas and Electric Company the most popular corporation, not only in California, but in the world.

Affability and courteousness, handled with firmness and distinct regard for the rights of others; the assumption that the consumer is right all of the time, and that if in error he must be convinced by reasonable argument; the putting of the house in order, cleanliness, neatness, both in dress and in appearance of the office and the works, extending even to the appearance of pole and wire lines; are things that assume the commendation of the public.

We are not wiser now than men were four hundred years ago, as will be evidenced by the following advice which Polonius gave to his son:

"See thou character. Give thy thoughts no tongue.
Nor any unapportion'd thought his act.
Be thou familiar, but by no means vulgar.
The friends thou hast, and their adoption tried,
Grapple them to thy soul with hoops of steel;
But do not dull thy palm with entertainment
Of each new-hatch'd, unfledg'd comrad. Beware
Of entrance to a quarrel; but, being in,
Bear't that the opposed may beware of thee.
Give every man thine ear, but few thy voice:
Take each man's censure, but reserve thy judgment.
Costly thy habit as thy purse can buy,
But not express'd in fancy; rich, not gaudy:
For the apparel oft proclaims the man;
And they in France of the best rank and station
Are of a select and generous chief in that.
Neither a borrower, nor a lender be:
For loan oft loses both itself and friend;
And borrowing dulls the edge of husbandry.
This above all,—To thine ownself be true;
And it must follow, as the night the day,
Thou canst not then be false to any man."

And the Editor advises each Manager to place this advice in the hands of each of his employees, with the request to carefully consider the same, and endeavor in every way to live up to the precepts therein contained.

A general order issued from the offiice of the President, May 2d, establishes the following changes in District Managers, effective as of June 1st, 1911:

A new department is created to be known as the "Appliance Department," with Mr. Lee H. Newbert, present Manager of the Redwood District, in charge.

Mr. Newbert will have charge of the sale of appliances, both gas and electric; also the sale of lamps, both arc and incandescent, all advertising and charge and disposition of all solicitors engaged in the obtaining of new business. His headquarters will be at the general offices, 445 Sutter Street.

The operation of this department will be confined to the distributing systems, and will have no reference to the territory outside of the distribution districts, which, as heretofore, will be under control of the Commercial Department.

Mr. E. W. Florence of Fresno District will assume the position and duties of manager of the Redwood District vice Mr. Lee H. Newbert.

Mr. W. H. Henderson, manager at Colusa, will assume the position of manager of Fresno District vice Mr. E. W. Florence.

The selection of a new Manager for Colusa District will be announced later.

The Yuba Construction Company of Marysville has the contract to build a "fifteen foot' dredge at Hammonton for the Yuba Consolidated Gold Fields. They have also the contract to build one at Oroville for the Natomas Consolidated. It is expected that the dredges will be in operation by July 1st. They require 800 H. P. each, and power will be furnished by the Pacific Gas and Electric Company.

Address by Mr. C. F. Adams before the North Side Improvement Club of Alameda

Mr. C. F. Adams, Construction Engineer of the Pacific Gas and Electric Company, made a very interesting address to the members of the North Side Improvement Club of Alameda, on Friday night, May 5th.

Mr. Adams preluded his remarks with the statement that the facts, which he desired to lay before the club, were to be purely unofficial, so far as his connection with the Pacific Gas and Electric Co. was concerned.

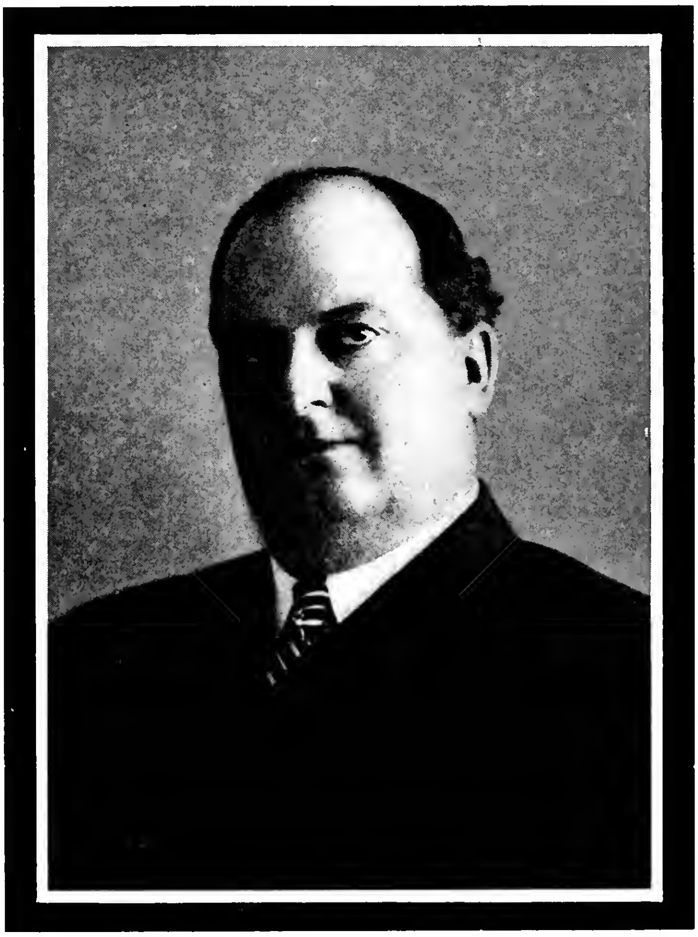
Mr. Adams constructed the original Municipal Electric Lighting Plant of the City of Alameda in the summer of 1886, and in a very forcible manner, touched upon the history of the lighting business in Alameda to date, calling attention to what, in his mind, had been a serious mistake to the city at large, in allowing certain old ordinances to exist; disbarring outside competitive lighting companies from entering the corporate limits of the city of Alameda, all of which had been detrimental to the growth of the city, had retarded the development of the Alameda Water Front, and as a wholesome comparison in the line of neglect, in securing large manufacturing plants for the city as a basic foundation for a larger municipality, compared Alameda with the remarkable growth, which has taken place in the City of Richmond, under conditions exactly the reverse of those which exist in Alameda.

Mr. Adams, subsequent to his address, was highly complimented upon the masterly manner in which he had handled his subject, and upon the broad-minded, liberal views which he had advanced, many of which were new to the members of the organization, and which will possibly be seed for mature thought, and the abolition of old obsolete policies, which have for many years stood in the way of a healthy growth of one of the most natural sites for a large city on San Francisco Bay.

R. J. C.

In Memoriam—Albert Cook McDavid

ON the morning of April 25th, 1911, there was transmitted to the thousands of employees in every part of our system, a severe mental shock, when it became known that Mr. A. C. McDavid, Right-of-Way Agent of the Company, had passed away suddenly at Smartsville, California, on the night of April 24th.



There is an old saying that a man to be successful in this life must not only make many friends, but must likewise have his enemies. Mr. A. C. McDavid was one of the exceptions to this generally considered rule, for a mere acquaintance with him meant friendship, and his friends were legion. No matter in what part of our great system you might wander, Mr. McDavid was well-known, had many friends and was always welcome. While the duties of a right-of-way agent for a large corporation are not always pleasant, McDavid had built up a reputation that when he had once gone through any given territory and secured a right of way for his Company, his business dealings were of that high moral standard and pleasant nature, that he could always go back to the same territory, as demands were made upon him for further rights of way, and secure the same courteous treatment and attention that had been accorded him in the first instance.

A man with a hearty laugh, a firm grip of the hand, and one of those rare fortunate natures that can only see the good side of life, who casts a ray of sunshine and mirth where ere he goes, and at the same time endowed with a perseverance and steadfastness of purpose that made him a leader in his line.

Mr. A. C. McDavid was born on February 4th, 1874, in Coffeen, Montgomery County, Illinois. His early life was spent in and around his native place, assisting his father on the home farm, and later teaching school, prior to his departure for the west. His first position on the Pacific Coast was in his uncle's store in Los Angeles. He came north to San Francisco, and in 1899 was sent by Mr. W. Frank Pierce to the Tiger Creek sawmill of the old Standard Electric Company, to check lumber for the Electra Power House flumes.

Subsequently he secured a position, under Mr. A. A. Davis, Superintendent of Construction of the Bay Counties Power Company, and later, in 1902-1903, was under Mr. R. E. Starkweather, as bookkeeper and material accountant, in the vicinity of Marys-

ville and Cordelia. In connection with this work he was oftimes delegated to secure rights of way for pole lines, and his marked ability for this class of work was soon recognized, and in 1903 he found employment in the home office of the California Gas and Electric Corporation, in San Francisco, as right-of-way agent, under Mr. John A. Britton, General Manager of that Company. When the Land Department was organized in 1904, Mr. McDavid became a part of that organization with the title of "Right-of-Way Agent," which position he held up to the time of his death.

Mr. McDavid leaves a wife to mourn his loss, to whom he was married in Sacramento in July, 1908, but no children. Of a family of twelve, Mr. McDavid was fourth in line of age, and was the first child of this large family to pass away. His father, a Presbyterian minister, is now living in the home town. Mr. McDavid carried with him through life, a high moral standard of character, his habits were exemplary, and he was a great lover of outdoor sports, being an enthusiastic baseball "fan," and a player of no mean ability. R. J. C.

To the Employees,
Pacific Gas and Electric Company,
San Francisco Gas and Electric Company.

I beg to introduce myself to your kind attention as mail boy in the main office, San Francisco. I am a contestant of record for one of the valuable prizes offered by the San Francisco Examiner, which contest closes July 4th, 1911.

In the San Francisco Daily and Sunday Examiners, a coupon is being run in each paper, such coupons counting for one vote if sent in within the prescribed time printed thereon.

Three months'	subscription	counts	for	300	votes
Six	"	"	"	750	"
One year's	"	"	"	1,500	"
Five "	"	"	"	12,000	"

I beg to respectively request that if you are not already committed to save these coupons, or contemplate subscribing to the paper, that you forward coupons or notify me at Room 304, 445 Sutter Street.

Very respectfully yours,
JOHN CALLAGHAN,
Mail Boy.

Choice

Not what we have, but what we use,
Not what we see, but what we choose;
These are the things that mar, or bless,
The sum of human happiness.

The thing nearby, not that afar
Not what we seem, but what we are;
These are the things that make or break,
That give the heart its joy or ache.

Not what seems fair, but what is true;
Not what we dream, but good we do;
These are the things that shine like gems,
Like stars in fortune's diadems.

Not as we take, but as we give,
Not as we pray, but as we live;
These are the things that make for peace,
Both now and after time shall cease.

—*The Outlook.*

Electricity Made Easy

The Fernie (B. C.) Free Press has recently had an electrical equipment installed and has consequently suddenly become electrically enthusiastic to the extent of printing the following definitions:

A transformer is an apparatus that hangs on a pole on the street and grinds the volts into domestic sizes for adjacent consumption.

A meter is an automatic case-keeper that is designed to keep the conscience of the consumer pure and untainted.

A motor is a Christian science medicine box that is influenced from the power house by absent treatment. The method of operation is as follows: The armature amperes the rheostat at the switchboard by kilowatting the voltage, thereby transforming the resistance into two-phase electromotive ohms, with which the motor absorbs the peak load on the cut-off. The dynamo reduces the insulation of the series wound exciter producing multipolar generators on the direct current, and you pay at the city clerk's office.—From *Ideal Power*, January 11.

Let There Be Light!

By L. JENNINGS, Accountant, De Sabla Power Division.

YES, let there be light! The turning of a little button brings it instantly. But is that all there is to it? How many out of the millions at whose constant service this light stands, count the cost, cost not in dollars and cents, but in earnest human endeavor?

Do they hear through the rush and roar of the mountain storm the steady hum of power houses hanging to some rocky point at the bottom of wild, rugged canyons hundreds of miles away, where every minute of the day and night, highly trained operators watch hour after hour, the smallest variation of their indicators with their hands on the switch levers, using their whole effort to maintain a perfect flow of current?

Do they hear the roar of the swollen mountain rivers pouring down through jagged canyons, carrying logs, rocks and trees in their path;— the avalanche tearing its way down the steep mountain sides, carrying away ditches; the giant trees crashing down through flumes which carry water to the distant power houses; the screaming of the hundreds of miles of transmission lines as the storm sweeps by them?

Do they know of the sleepless nights at the penstocks, where hour after hour with pike and axe the men break up the floating ice, clear the path for the water with the blinding sleet and snow cutting their faces; the sleeping men in the bunkhouses roused by the foreman's call to repair a break ten miles distant in the face of a gale?

Do they consider the handling of the load of thousands of horse-power generated in the mountain power houses to light the streets, theatres, hotels, homes, and run the cars and factories in the far-distant cities, as line after line of the intricate system goes down, making it necessary to handle the tremendous load over other lines?

Do they realize what that little bright light costs? Would they be so ready to censure if they knew?

Extension of Distribution System

Electrical World, July 21, 1910.

The Public Service Commission, Second District, N. Y., rules:—Where the main is already in the street and within 100 feet of the premises to be supplied, the following division of expenses is reasonable and proper: That the gas company assume the cost of the service from main to curb, and compel the consumer to pay the cost from curb to meter.

Where the main is in the street and the premises to be supplied are more than 100 feet from the main, and also where the main is not in the street or has not been brought to the point where it is within 100 feet of the premises, the powers of the commission allow it to order extensions; but the commission will exercise discretion as to the reasonableness of ordering such extension.

The company should charge all consumers for curb-to-house services, and must desist from the practice of installing services from curb to house lines free of charge in cases where consumers' houses are not wired for electricity and where the consumer obviously expects to use gas exclusively. The commission also rules that the cost of such installations may be apportioned on the basis of gas consumed or to be consumed.

Tungsten Lamps

By G. S. MERRILL. *Proc. of A. I. E. E.*, Sept., 1910.

Tungsten is reduced from the yellow oxide by hydrogen at a red heat and is obtained in a slightly spongy form. The binding material is usually starch, sugar or camphor. The putty is squeezed from a steel cylinder at a pressure of 32,000 lbs. per square inch through a diamond die, the diameter of the hole being sometimes as small at 0.0014 inch. The die has to be rebored after squirting filaments for 1,500 lamps, but this cannot be done more than twice before it develops cracks.

The agglutinant is removed by a reducing process, and the filament is finally raised to a very high temperature, when it contracts suddenly and the forming process is complete.

Soft copper is mostly used for the supports because it does not alloy with tungsten. A very high vacuum is required and the temperature must be raised very steadily throughout the forming process, if the best structure, free from any trace of granularity is to be obtained.

The candlepower varies as the 3.68th power of the voltage and the watts as the 1.59th power; the efficiency varies inversely as the 1.75th power of the candlepower. The specific resistance of tungsten is 46.5 ohms per mil-inch at a temperature corresponding to 1.25 watts per candlepower, and 4.19 ohms per mil-inch at ordinary room temperature. It takes the 250-watt lamp, burning at 1.25 watts per candlepower, 58 seconds after being turned off, to fall to 200% of its initial cold resistance, while it takes the 60-watt lamp only 20 seconds, the 25-watt lamp 11 seconds, and the small-voltage sign lamp a little over 6 seconds. The writer claims that the efficiency is due partly to selective radiation and partly due to a higher temperature. Under normal working conditions, the tungsten lamp gives relatively more blue radiation than the carbon lamp for an equal amount of red. For a given voltage and candle-power the carbon lamp has less tendency to flicker on low frequencies than the tungsten lamp.

A very interesting article appeared in the "Los Angeles Express," April 12th, 1911, covering the general construction of a new power plant, which is being erected for the Southern California Edison Company at Long Beach.

The plant will cover about one acre of ground, and it is estimated that the first unit of 16,000 horse-power will be in operation by July 1st. A second unit of 20,000 horse-power is contemplated for one year later.

The buildings are four stories in height, of reinforced concrete. This will be a steam-generating plant with eight Sterling boilers, using crude oil for fuel. The power will be generated at 11,000 volts, and will be distributed at 11,000, 30,000, and 60,000 volts.

They Say

No more interesting exchange comes to the Round Table's *desk than the* PACIFIC GAS AND ELECTRIC MAGAZINE, *published monthly by the Pacific Gas and Electric Company, San Francisco. The current issue of this large and beautifully printed publication contains among a number of other excellent features, "A Description of the Bear River Reservoir," by Will T. Jones, and a fine address by Frank B. Anderson, president of the Bank of California, on the subject of "Morals in Trade and Commerce." It is a pity that such a fine organization and such an ably conducted magazine should still linger outside of the "charmed circle" of the N. E. L. A. What's the matter with sending a missionary to San Francisco to convert the P. G. and E. people?*

—*Edison Round Table*, April, 1911.

PERSONALS

The San Mateo Lodge of Elks, 1112, installed their officers for the year commencing April 1st, at a session held Wednesday, April 5th. About one hundred and fifty members of the lodge witnessed the installation. Retiring Exalted Ruler, L. H. Newbert, our District Manager at Redwood, was presented with a handsime chest of silver, as a token of the lodge's appreciation of his services in the past. The annual banquet was held at the Peninsular Hotel, April 22d.

Married, Saturday, April 29th, at the residence of the bride's parents, 3621 Clay Street, Miss Agnes Hunter, to Mr. George H. Rand, Field Agent, connected with the Land Department of the Company. After an elaborate wedding breakfast they left for a honeymoon trip via steamer to Los Angeles.

Married, at Hollister, April 25th, Miss Kearny, niece of Judge M. T. Dooling, to Mr. John P. Coghlan, Manager of the Claims Department of the company.

Mr. John A. Britton and party left for Honolulu on the S. S. Siberia, Wednesday, May 3d, and will tour the Islands. They will return in about one month.

A joint meeting of the Association of District Managers and Division Superintendents was held at the office of the Company, 445 Sutter Street, San Francisco, at 3:00 P. M., Saturday, April 29th.

This meeting was adjourned at 4:30 P. M. and reconvened at 6:00 P. M. in the St. Francis Hotel, where dinner was served.

The evening, between 8:30 and 12:00 midnight was taken up by lantern-slide views of the Company's properties, and addresses by the different Managers and Superintendents, in explanation thereof.

To the wife of Mr. F. R. Cleveland, foreman of the Oroville substation, Marysville Power Division, a nine-pound boy, born in April, 1911.

The Poet Laureate's Vacation

"Farewell, boys, I'm leaving now,
You know I'm going to take
My annual vacation
On the banks of 'Sweet Stow Lake.'

"I'll be away for fourteen days
It won't take long to go,
If the boss should want me badly,
Call up G. G. 4—0.

"Teddy went to Africa
To steal a march on me,
But wait 'till I return,
What a 'dub' he'll seem to be.

"I'll have specimens of gold fish,
Squirrels and cockatoo,
I'll have pictures of the buffalo,
The moose and the kangaroo.

"I'll be an expert naturalist,
A real Burbank for fair,
I'll know every monument in the Park,
And ev'ry 'Sousa Air.'

"I'll make trips to the Cliff House,
To see my friends up close—
Seals know familiar faces
Like that of Eugene Beauce.

"I'll stand in well with all the cops,
So you stand in with me,
Should you get pinched for speeding,
Just call on E. A. B.

"When I get to work again, boys,
Think, you, won't it be fine,
Knuckling down to green inks
With the boys along the line?

"A good sketch of my holidays
Can easily be seen,
By contributing just fifteen cents
For the 'Pacific Magazine'."

I. FITZGERALD,
Bookkeeping Dept., S. F. G. & E. Co.

Miss Laura Bennett, the stenographer for Fresno District, has tendered her resignation to take effect June 1st. It is understood that Miss Bennett is to be married to Mr. D. A. Wakefield, the bookkeeper for the Fresno office. Mr. Wakefield has prepared a beautiful bungalow for his bride.

The employees of Fresno District all wish them much happiness and success in their new undertaking.

We are in receipt of a very interesting article from Mr. Van E. Britton, bringing to attention the fact that Mr. R. C. Lamphier of the Sangamo Electric Company, Springfield, Illinois, and Mr. H. W. Young of Chicago, have just developed a new type of Graphic Recording meter, which, according to reports, is a radical departure and great improvement over the forms heretofore employed.

The General Electric Company is experiencing a very large business in their new CP-27 type air-brake compressors, shown by the receipt of the following orders:

United R. R. of S. F., 80 equipments; Oakland Traction Co., 60; Public Service Ry., Newark, N. J., 140; Springfield St. Ry. Co., Mass., 50; Connecticut Co., New Haven, Conn., 20; Grand Rapids St. Ry. Co., 32; and Duluth St. Ry. Co., 19.

The day returns and brings us the petty round of irritating concerns and duties. Help us to play the man, help us to perform them with laughter and kind faces; let cheerfulness abound with industry. Give us to go blithely on our business all this day, bring us to our resting beds weary and content and undishonored, and grant us in the end the gift of sleep. Amen.—*Robert Louis Stevenson.*

RELATIVE TO BINDING VOLUME II. OF THIS MAGAZINE

The present issue is the last of Volume No. 2 and, as was done with the first volume, each District and Division will be supplied with a copy, bound in buckram, for the office library.

Those having all copies of Volume 2 in good condition, may have them bound in the same manner by forwarding them, charges prepaid, to the Stationery Department on or before June 5th.

The charge for binding will be 45 cents. If the book is to be delivered outside of the Company's offices or stations in San Francisco there will be an additional charge of 26 cents to cover postage.

Collection will be made upon delivery of the bound copy.

Packages containing magazines should be addressed

STATIONERY DEPARTMENT
PACIFIC GAS AND ELECTRIC CO.
445 SUTTER STREET
SAN FRANCISCO

Name of sender with full and complete address must be plainly marked on each package.

QUESTION BOX

Ask questions. Any one of the several thousand men and women in the Pacific Gas and Electric Company who wishes information pertaining to any phase of the company's work or concerning matters of common interest to residents of any section reached by the company's lines is urged to use this department freely. Send your questions to the magazine. There will be no charge.

Question.—How do Mineral Seal and Transil oil differ chemically.

Answer.—They are chemically the same.

Question.—What are the advantages peculiar to each in electrical applications?

Answer.—Transil has better lubricating qualities and is, therefore, better for use in oil switches, regulator heads, etc., where there are moving contacts. It has the disadvantage of becoming thick and of depositing vaseline on coils, cooling coils, etc. Mineral seal oil being much lighter gives better circulation in transformers and does not cause deposits in oil ducts, etc. It has little or no lubricating value.

Question.—What objections are there to mixing the two in a transformer or oil-switch?

Answer.—None. The only effect would be to change the viscosity.

Question.—Is it considered good practice to dry transformer oil by boiling, for instance, by using an electric heater in the tank of oil? Is not the oil carbonized to a considerable extent by heat sufficient to vaporize water at the bottom of a tank of oil?

Answer.—Yes, if carefully done, oil is not damaged at the temperature necessary to drive off the water.

Question.—Is the method of drying oil with chemicals considered better than the method of drying by heat?

Answer.—Chemical drying is more expensive and inconvenient.

Question.—What is the law in this State regarding the deduction of Poll-Tax from an employee's pay? W. H. S.

Answer.—The law of this State relating to the deduction of the poll tax from an employee's pay is contained in Sections 3848 and 3850 of the Political Code, which are as follows:

Sec. 3848. Debtors of Persons Owing Poll-Tax to Pay Poll-Tax for such Persons: Every person indebted to one who neglects or refuses, after demand, to pay a poll-tax, becomes liable therefor, and must pay the same for such other person after service upon him by the collector of a notice in writing, stating the name of such person.

Sec. 3850. Debtor May Charge Creditor for such Poll-Tax Paid: Every person paying the poll-tax of another may deduct the same from any indebtedness to such other person.

Please note that the debtor of the person owing the poll-tax is under no obligation to pay the poll-tax unless the person from whom the same is due neglects or refuses, after demand, to pay it, but that such debtor, even if he voluntarily pays the tax, is entitled to deduct the amount paid from his indebtedness to the person for whose account he made the payment. WM. B. BOSLEY.

Question.—How can two water boilers or tanks be connected to one water back so that each will take their equal share of hot water? G. A. H.

Answer.—Bypass the two boilers, both top and bottom, and connect water back to center of bypasses. S. B. H.

Question.—Is it possible to estimate and give speed of flow of water through the nozzles in the hydro-electric power houses?

Answer.—Yes; taking Electra Power House for example, the exact figures are 3.4 miles per minute.

Question.—When was the present Electra Power House placed in service?

Answer.—1902.

PACIFIC GAS AND ELECTRIC COMPANY

DIRECTORS

F. B. Anderson
Henry E. Bothin
John A. Britton
W. H. Crocker
E. J. De Sabla, Jr.
F. G. Drum
John S. Drum
D. H. Foote
A. F. Hockenbeamer
John Martin
Louis Monteagle
Cyrus Peirce
Leon Sloss
Joseph S. Tobin
George K. Weeks

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John A. Britton........Vice-Pres. and Gen. Mgr.
A. F. Hockenbeamer.....2d Vice-Pres., Treas. and Comp.
George C. Holberton..Engr. & Gen. Mgr. S. F. G & E. Co.
D. H. Foote........Secretary
Charles L. Barrett........Asst. Secretary
W. R. Eckart........Consulting Engineer
J. H. Wise........Consulting Engineer

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J. C. Love........Auditor
W. H. Kline........General Agent
R. J. Cantrell........Property Agent
George C. Robb........Supt. of Supplies
J. H. Hunt........Purchasing Agent
E. B. Henley........Manager Land Dept.
J. P. Coghlan........Manager Claims Dept.
H. Bostwick........Secretary to President
S. V. Walton........Manager Commercial Dept.
F. E. Cronise........Manager New-Business Dept.
W. B. Bosley........Attorney
H. C. Vensano........Civil Engineer
E. C. Jones........Engr. Gas Dept.
H. P. Pitts........Industrial Engineer
F. F. Barbour........Assistant to President
S. J. Lisberger........Engr. Electric Distribution
Sherwood Grover........Asst. Engr. Gas Department
C. F. Adams........Engr. of Electric Construction
P. M. Downing........Engr. O. & M. Hyd.-Elec. Sect.
C. J. Wilson........Asst. Engr. Electric Distribution
F. H. Varney.........Engr. O. & M. Steam & Gas Eng. Sect.

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Auburn........H. M. Cooper
Berkeley........F. A. Leach, Jr.
Chico........H. B. Heryford
Colusa........W. M. Henderson
Dixon........C. E. Sedgwick
Fresno........E. W. Florence
Grass Valley........John Werry
Martinez........Don C. Ray
Marysville........J. E. Poingdestre
Napa........O. E. Clark
Nevada City........John Werry
Newman........W. A. Widenmann
Oakland........F. A. Leach, Jr.
Petaluma........H. Weber
Redwood City........L. H. Newbert
Sacramento........C. W. McKillip
San Jose........J. D. Kuster
San Rafael........W. H. Foster
Santa Rosa........M. G. Hall
Vallejo........A. J. Stephens
Woodland........W. E. Osborn

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Nevada (Nevada City)........George Scarfe
Placer (East Auburn)........H. M. Cooper
Standard (Electra)........W. E. Eskew
Stockton (Stockton)........J. W. Hall

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De Sabla........I. B. Adams
Electra........W. E. Eskew
Marysville........C. E. Young
Nevada........George Scarfe
North Tower........C. D. Clark
Oakland........William Hughes
Sacramento........J. O. Tobey
San Jose........J. O. Hansen
South Tower........A. H. Burnett
Stockton........E. C. Monahan
Solano........J. W. Coons, Acting

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San Francisco........A. R. Thompson
Oakland and Alameda (Overhead)........A. U. Brandt

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Oakland........A. C. Beck
Sacramento........Edward S. Jones
San Francisco........Dennis J. Lucey
San Jose........R. H. Hargreaves

SUPERINTENDENTS OF GAS DISTRIBUTION

Oakland........George Kirk
San Francisco........W. R. Morgan

THE PACIFIC GAS AND ELECTRIC COMPANY

SUPPLIES HEAT, LIGHT AND POWER TO

Place.	Population.
Agua Caliente	50
*Alameda	23,383
**Albany	800
‡Alta	200
Alto	30
Alvarado	200
Allegheny	200
Amador	200
Angels Camp	3,200
Antioch	3,000
‡Auburn	2,376
Baden	1,500
Barber	200
**Belmont	600
Belvedere	481
Benicia	3,360
Ben Lomond	800
**Berkeley	40,434
Bethany	200
Big Oak Flat	150
Biggs	750
Black Diamond	500
Bohemian Grove	25
Brentwood	200
Brighton	100
Broderick	500
‡Brown's Valley	50
**Burlingame	5,000
Byron	200
Campbell	1,000
Camp Meeker	200
Cement	1,500
Centerville	500
‡Centerville	20
**Chico	13,000
Chittenden	50
**Colusa	1,582
‡Colfax	400
Colma	500
Concord	1,500
Cordelia	150
Corte Madera	350
Cordova	25
Cornwall	300
Crockett	2,500
Crow's Landing	375
Davenport	1,000
Davis	750
Decoto	350
‡Dixon	1,000
Dobbins	50
Drytown	100
Duncan Mills	150
Durham	500
‡Dutch Flat	400
Eagle Nest	50
‡East Auburn	1,500
**Easton	500
**East San Jose	1,500
Eckley	20
Eldridge	1,000
‡Electra	50
Elmira	150
El Verano	100
Emerald	50
**Emeryville	2,000
Encinal	20
Fairfax	250
Fairfield	800
**Fair Oaks	250
Folsom	1,500
Forestville	100
*Fresno	24,892
Gilroy	2,000
Glen Ellen	500
Gold Run	100
Grafton	350
†Grass Valley	4,520
Gridley	1,800
Groveland	50
Guerneville	500
Hammonton	500
**Hayward	4,000
Hollister	3,000
Ignacio	50
Ione	900
Irvington	1,000
Jackson	2,035
Jackson Gate	50
Kennedy Flat	50
Kentfield	200
Knight's Landing	350
Larkspur	594
Lawrence	100
‡Lincoln	1,402
‡Live Oak	200
Livingston	200
Livermore	2,250
‡Loomis	150
Los Altos	200
Los Gatos	3,000
Manlove	50
Mare Island	500
Martell	25
Martinez	5,000
**Marysville	5,430
Mayfield	1,500
Mayhew	50
**Menlo Park	1,500
Meridian	300
Middle River	75
Mill's College	150
**Milbrae	300
Mills	350
Mill Valley	2,551
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Mountain View	2,500
**Napa	5,791
Napa Junction	250
†Nevada City	2,689
Newark	700
†Newcastle	600
New Chicago	25
Newman	1,000
Niles	800
Novato	250
**Oakland	225,000
**Oak Park	8,000
Occidental	400
Ophir	50
Oroville	2,500
Orwood	50
Oswald	25
Pacheco	200
**Palo Alto	6,000
Patterson	100
**Penon Blanco	25
†Penryn	250
Perkins	200
**Petaluma	5,880
Peyton	250
**Piedmont	2,000
Pike City	200
Pinole	1,500
Pleasanton	2,000
Port Costa	600
**Redwood City	3,500
**Richmond	6,802
Rio Vista	884
†Rocklin	1,026
Rodeo	100
‡Roseville	2,608
Ross	556
Routier	30
***Sacramento	52,000
San Andreas	200
San Anselmo	1,531
San Bruno	1,500
San Carlos	100
**San Francisco	416,912
**San Jose	40,000
San Juan	150
**San Leandro	4,000
San Lorenzo	100
**San Mateo	7,000
San Pablo	1,000
**San Quentin Prison	1,600
**San Rafael	5,934
Santa Clara	8,000
Santa Cruz	11,146
**Santa Rosa	7,817
Saratoga	200
Sargent	50
Sausalito	2,383
Sebastopol	1,233
Selby	100
Smartsville	300
Sonoma	1,200
So. San Francisco	2,500
Stanford University	2,000
Stege	100
†Stockton	23,253
Suisun	1,200
Sunnyvale	2,000
Sutter Creek	2,000
Telton	300
Terminus	50
Tiburon	100
Tormey	150
†Towle	200
Tracy	1,200
Vacaville	1,177
**Vallejo	11,340
Vallejo Junction	10
Vernalis	50
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,446
Wheatland	1,400
Winters	1,200
**Woodland	3,187
Yolo	350
**Yuba City	1,160

*—Gas	48,275
**—Gas and Electricity	838,844
‡—Electricity and Water	35,685
***—Gas, Elec. and Street Car Service	52,000
†—Electricity, Gas and Water	7,209
Unmarked—Electricity only	127,428
	1,109,441

Service Furnished.	Number of Towns.	Total Population.
Electricity	204	1,061,166
Gas	52	946,328
Water	20	42,894
Street Car	1	52,000

EMPLOYS 3,500 people

OPERATES 11 hydro-electric plants in the mountains
3 steam-driven electric plants in big cities
18 gas works

SERVES ⅔ of California's population
30 of California's 56 counties
An area of 37,950 square miles
⅗ the size of New York state
½ the size of all the New England states combined